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SCIENCE & TECHNOLOGY POLICY

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FRG: LUFTHANSA DEAL WITH AIRBUS, IAE ENGINE GROUP STRAINED

Duesseldorf HANDELSBLATT in German 18 May 87 p 23

[Article: "Lufthansa Vice President Reinhardt Abraham: Relationship to Airbus and IAE Engine Consortium Strained. Rolls Royce's Shortage of Time Stopped the SuperFan."]

[Text Duesseldorf, 16/17 May 87--Airbus Industrie has suffered a sharp setback in the battle for the world commercial aircraft market: The international engine consortium IAE, to which belong topflight names like Pratt & Whitney (United Technologies concern) and Rolls Royce, but also renowned smaller manufacturers like Fiat, the Japanese Aero Engines, and the Daimler-Benz subsidiary MTU [Motor and Turbine Union], will not be building the planned "SuperFan" engine for the four-jet, long-range A340 Airbus. This also creates a wholly new situation for Lufthansa, which had a firm order for 15 A340s and an option for as many again.

As Lufthansa Deputy Chairman of the Board Reinhardt Abraham explained in an interview with the amateur pilot magazine AEROKURIER, this contract will have to be completely re-examined, since Lufthansa was definitely counting on the development of the economical and high-performance "SuperFan."

Lufthansa, he said, will have to decide soon whether it will stay with its order for the A340 Airbus, even with the conventional, higher fuel consumption or less an enhancement of the trusty DC-10. According to the projected performance and consumption data, the A340 with the V2500 SuperFan would have used about 10 percent less fuel than the MD-11. This lead now shrinks to just 6 percent. This also affects the A340's range, which now will come to around 500 to 600 km less than originally expected.

According to Abraham, it was in no way the smaller partners in the IAE consortium who caused the SuperFan's downfall, but rather the top managers of the two larger ones, namely Rolls Royce and Pratt & Whitney. They were not willing to accept the scheduling and financial risks of developing and putting into production an engine based on new technology by 1992. When the preliminary contract for 30 A340s was signed, however, Lufthansa was not aware of any reservations concerning the engine on the part of IAE or Airbus Industrie.

The preliminary contract's silence concerning reservation about the engine has in a way strained the trusting relationship between Lufthansa on the one hand and the two manufacturers, IAE and Airbus Industrie, on the other. The technicians at Lufthansa did expert certain difficulties in developing a new engine of this sort, but they relied on the seriousness of their partners' statements, who do after all account for some 70 percent of the world airplane engine capacity. All the more so, since the essentially even more technically promising prop-fan engine is supposed to be in operation by 1992.

In Abraham's opinion, the main technical and economic obstacle was the delay, especially at Rolls Royce, in developing the V2500 engine for the short-range A320 Airbus. And this engine is the basis for the SuperFan. Meanwhile, they have found that despite the advanced state of the A320 project, the high-pressure compressor for the V2500 engine will have to be developed completely from scratch. The industrial responsibility for this has passed from Rolls Royce to Pratt & Whitney. Abraham believes that the SuperFan program has run aground not because of problems with the fan technology but, in an entirely conventional area, because of problems with the high-pressure section of the V2500. The people within the IAE consortium are simply afraid of their own courage.

Abraham does not want to exclude or confirm the possibility that, in addition to the technical motives for stopping the program, political quarrels also played a role. Nonetheless, there are strong forces in Pratt & Whitney's management favoring the PW4000 program. This engine is planned, among others, for a competitor of the A340, the MD-11. Thus, with the development of the SuperFan, they would have built yet another in-house competitor. Since Pratt & Witney did, on the other hand, decide to be a leading partner in the IAE engine consortium, one has to act on the assumption that the engine recently brought under development will also be realized, despite this in-house conflict.

Abraham argues that the governments involved should make their financial decisions concerning the A340 program by the Paris Air Show at the beginning of June, so that the producers and the consumers can make their plans. If Lufthansa decides this month for the A340 and the improved but conventional CFM 56-5C1 turbo-fan engines, then they will be taking a smaller scheduling risk than with the SuperFan, but will be getting the same performance with a good 30,000 lbs of thrust (136 kilonewtons). This engine's higher fuel consumption might be offset by lower maintenance costs.

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SKYLARK ROCKET EXPLOSION SETBACK FOR FRG TEXUS PROJECT

Duesseldorf HANDELSBLATT in German 18 May 87 p 23

[Article by Anatol Johansen: "Ten Years of the TEXUS Program--Failure on Its Anniversary. Parabolic Flights into Space for Research in Weightlessness"]

[Text] 16/17 May 87--After rocket failures by the Americans, Europeans, and the Russians, now an English "Skylark" high-altitude research rocket has exploded, right at the launching of the 400th rocket of this type.

The Skylark launching from the Swedish Esrange launch site north of the Arctic Circle in Kiruna was supposed to have been a special sort of jubilee. For the launching of the 13-meter long, roughly 2-ton, two-stage solid-fuel rocket marked the 10th anniversary of the German TEXUS (Technological Experiments in Weightlessness) program, whose considerable successes have gained international attention. It has even gotten to the point that American experts say that the Germans are currently ahead in materials research in space. And that is saying quite a bit when one considers that TEXUS concerns only so-called parabolic flights, not satellite flights.

Thus, the failure of last weekend (9 May 87) was rather inopportune. The rocket did still race straight as an arrow from its launching pad into the Arctic sky and disappear immediately in a dense layer of clouds. Normally, the shot would have carried its scientific payload to a peak altitude of some 250 km. Then later, it would have returned to earth by parachute and been recovered undamaged--as has happened most successfully a dozen times in previous years.

The principle under which TEXUS normally operates is very simple, for the firm of Messerschmitt-Boelkow-Blohm (MBB-Erno) makes things extremely easy for experiments who want to perform technological experiments and other experiments important to science and industry in weightlessness. They developed a standardized service module, into which an automatically operating mini-laboratory designed for a specific experiment can be integrated. For each launch, between five and seven of these mini-laboratories can be built, one on top of the other, into the 5-meter-long payload nose of the Skylark rocket. In addition, it has even become recently possible to transmit the progress of a specific project live from the weightless rocket to a screen on earth. Thus, the experimenter can follow the course of his experiment very precisely (in real time).

Moreover, the experiments are relatively inexpensive. While a normal, unmanned research satellite, including the launch, currently costs far more than DM 100 million on the average--use of the manned European Spacelab can even run to DM 400 million, the more than 170 experiments in the TEXUS program over the past 10 years have been carried out for around DM 100 million. No wonder that, in the meantime, not only German reserchers but also scientists from all over Europe, Japan, and even the United States are standing in line--NASA abandoned its own unmanned, high-altitude research rocket program in 1982/83 in favor of the space transport; the Japanese also had to stop their program. Meanwhile, a series of interesting experiments is running at TEXUS, which are of great importance not only for science but also, in the medium term, for industry. They include, among others, an experimental, optimal compound of tungsten carbide and cobalt carbide, not possible on earth, for producing an improved hard metal. An alloy of lead and aluminum in weightlessness, which likewise is not possible on earth because of the differing specific gravities of the two metals, would be a new, optimal material for friction bearings of all sorts. Developing new, successful methods of producing gallium-arsenic crystals in space could revolutionize the entire computer industry.

With these successes the future of TEXUS looks very favorable, despite the long faces in Kiruna last weekend. Consequently, the current firing rate of two launches per year is supposed to be raised to four. As has been the case thus far, the launches will all be carried out by the German Research and Experiment Institute for Aeronautics and Astronautics (DFVLR). They are also already considering larger rockets that would climb not to a height of 250 km but to 1000 km, in which case the weightless conditions would last 20 minutes instead of just the current 6.

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FINLAND IN ESA: RESEARCH, ELECTRONICS EQUIPMENT, PROSPECTS

UK Space Expert Assessment

Helsinki SUOMEN KUVALEHTI in Finnish 29 May 87 pp 68-70

[Article by Jukka Ukkola: "Space Scientist Roy Gibson: 'Finnish Electronics Is Ready for Space'"]

[Text] Finland joined the European Space Agency ESA at a truly opportune moment. Space research is just now at crossroads and ESA has the kind of future which should interest the Finns, Gibson assures us.

According to the new nature of space studies he sees the greatest marketing possibilities on the surface of earth. "For example we constantly send meteorological communications to cars, ships and airplanes via satellite and at the same time data transfers are otherwise also increasing between bases. A truly enormous increase is expected in these markets - especially since even the US instruments for small craft are at present rather primitive."

Gibson, along with the technological development center Tekes, has charted the potential of Finnish industry for ESA purposes and is convinced: "The level of Finnish electronics technology made a great impression on me. It is especially well suited for space research." He especially singles out Mobira's radio telephones.

For years the large airplane enterprises, such as British Airways and Messerschmidt, also had a monopoly on space business. Now we are past that phase; now a period of electronics, programming, artificial intelligence and robotics has begun.

"It will also bring in those countries which do not have their own aircraft industries, and new enterprises, such as Nokia, Lohja and all others which do not have space experience, but have electronic capability and suitable devices. Ten years ago it would have been much more difficult."

In addition to markets Gibson also promises Finland, as ESA member, access to advanced information. ESA is like a club in which its members can, with

relatively small investment, get their hands on space data which is difficult to get elsewhere. When one possesses that information, it can be used to determine in which areas special demand will develop, that might fit into ones own production, or even to guide development in desired direction.

Cooperation in All Directions

Gibson emphasizes the apolitical nature of the European Space Agency and its purely peaceful goals. Many member nations, such as Sweden, Switzerland and Austria are very careful to keep politics out of ESA.

"It is to the advantage of the entire agency to remain apolitical so that it can retain its cooperative channels in all directions. For example, England has just signed an agreement for cooperative space research with the USSR. From our point of view there is no contradiction in that we belong to the ESA and at the same time cooperate with the US and the USSR as well as China."

Gibson says he has information about the US "Star Wars," or SDI, but purely from the professional point of view. "I wish to follow the development of the technology, but otherwise remain aloof from the matter, because in SDI politics enters the picture. ESA as an agency is in no way associated with SDI, and even in England such matters belong to the ministry of defense and not to a space center."

Decisionmakers Should Wake Up

According to Gibson there are also clear differences between Western Europe and other centers in the area of non-military space research.

"When the Japanese, for example, decide to implement a long-term space program they will see it to its realization. In Europe it often happens that we wax enthusiastic one year and allocate funds; next year the funding is forgotten."

It is the arduous task of space politicians to explain to the taxpayers and decisionmakers that the research funds are not being wasted. People of our time got used to the fact that in space we went ever further and further. When man reached the moon, but no further, enthusiasm waned and the entire space research effort began to be viewed somewhat as a game for overgrown boys.

Many Europeans don't even know that our continent has a well developed space science, in some areas in a leading position in the world.

"Unless our decisionmakers wake up there is a danger that our science will still be funded in the 1990's with the attitudes of the '60's, as mere space adventurism, narrowly conceived. The field has broadened so much that it now touches almost all administrative areas, quite a few areas of industry and the common man on the street."

Aging Astronauts

The director gives examples of the creation of space science: "Medical science acquired a new opportunity for research when it was noted that the astronauts' presence in space quickly resulted in phenomena similar to aging or long bed rest. It is due to the fact that under weightlessness muscles get lighter. Astronauts can thus be used guinea pigs and with their help aging can be understood better than before. Some of our best experiments are done by medical researchers who know nothing about space, but study bones and blood."

Other comparable instances exist: in crystal research, vaccines, development of new materials - not to mention the already familiar meteorology. The weightless sky laboratories are irreplaceable places for any research in which the structure of a substance has to be studied under as "pure" conditions as possible, without having its molecules affected by gravity.

Artificial intelligence is also used in the training of astronauts by teaching the computer each student's weak points, for example, that someone always forgets something. Then when he is confronted with a task in which the weakness could become a handicap, the computer asks either for a change of person or reminds him.

Of course such a system can have all kinds of uses elsewhere besides in space. Space training artificial intelligence is already now being studied for application to language instruction.

"In the future space stations will be complete multiscientific laboratories, which will have a permanent crew and continuous contact with terrestrial scientists."

Robots Are Coming

It is estimated that the ESA space station will be completed and in full operation within about ten years.

Until then robots will be the most developed aspect of space technology, because keeping astronauts in space is expensive. Similar robots are needed at the bottom of the ocean or even at the oil drilling derricks.

"I have always been somewhat uneasy about the use of astronauts. From my point of view there isn't much utility in it, as visible as it is otherwise. We in Europe don't care as much for "show," although the punishment for that is that the man on the street doesn't know what we are doing."

According to Gibson the destruction of the American space shuttle Challenger demonstrated the necessity for having two simultaneous research orientations, one manned, the other unmanned. "We told NASA this already 15 years ago, but they didn't want to listen then. A man in space is a rather rare resource; for the most part we have to be satisfied with electronics. In spite of this we will have also European astronauts in space, but not very many."

New Generation Shuttles

The destruction of Challenger was altogether quite costly, because new ventures had to be postponed or frozen on account of it. On the other hand it also meant the revitalization of American carrier rocket industry, because it was no longer possible to depend entirely on the former shuttle. The new start means considerable competition for the European carrier rocket Ariane.

The British contribution to the shuttle competition is called Hotol, a next generation carrier rocket, which can take a seven ton payload. "It is awesome - I remember how I lost my night's sleep after building my first rocket, when it managed to tow 60 kilograms into space."

Hotol is much more developed than other shuttles. It rises from a runway like an airplane and does not drop its fuel tanks during its trip like the present shuttles, but takes them along into space and brings them back as well. This succeeds because Hotol has a very smart motor, which can utilize the atmospheric oxygen as high up as it exists. Then the same motor begins to use liquid oxygen which it has in fuel tanks. In this way it can save enormous amounts of fuel during the first minutes.

Hotol trips, however, are still quite far off since the craft will not be ready until the beginning of the year 2000. For now,the venture is only British, but efforts are made to fit it into the ESA program.

Space Research Intensifies

Helsinki HELSINGIN SANOMAT in Finnish 18 May 87 p 24

[Article: "Space Research Intensifies also in Finland"]

[Text] Finns are now strongly committed to space research. Domestic space research is being generated at centers of higher education, the capital area, Tampere, Turku and Oulu. Commercial enterprises are also preparing to take part in space ventures.

Space research vistas were sounded for two days at a Space Technology and Space Hardware seminar which ended Friday at the Tampere Technical Institute. Representatives of the European Space Agency, ESA, participated in the seminar.

Mikel Lumme, the secretary of the Space Affairs Committee founded 1985 in our country, said that the operative side, meaning data transfer and meteorology, is in good shape in Finland. That will not change, but now Finns are also joining in the development of space hardware.

Lumme explained that the development of space hardware is based on two state agreements. Finland's membership in the ESA became effective at the beginning of this year. A space affairs accord was signed with the USSR on January 7, 1987.

According to Lumme membership in the ESA means that Finland will be able to participate in the science program and remote mapping venture, which refers to the study of earth from space. ESA also has other programs which Finland will possibly join later. They include a space station program and a program for the development of the Ariane booster rocket.

Twenty million markkas has been set aside for space ventures this year. Half of it goes for ESA membership dues and the other half for domestic ventures. The aim is to increase the funding by steps so that in the year 1992 the sum would be 80 million markkas.

Finnish Components for Mars Car

Dr Risto Pellinen from the Aeronautical Sciences Institute told us that the Institute is manufacturing four research devices for the Soviet probes and one satellite. The value of the Finnish share is about 10 million markkas.

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FIAT REORGANIZES AUTO EQUIPMENT ACTIVITIES

Paris L'USINE NOUVELLE in French 7 May 87 p 34

[Article by Alain Pauche and Georges Le Gall: "Fiat Chasing Valeo"]

[Text] Neither in machine components nor in auto components has Fiat lost any of its appetite. But in this latter field, its ambitions are vast indeed. Alessandro Barberis, general manager of Magneti-Marelli, Fiat's auto-components subsidiary, is aiming at the coveted number-two spot in Europe. Though it cannot hope to overtake Bosch, the undisputed leader, Fiat wants to rival Valeo, whose corporate prime mover is none other than Carlo De Benedetti, and L'Anglais Lucas.

Before trumpeting its ambitions, Fiat had to make a profound reorganization of its corporate structure and product lines. At the end of 1986, Magneti-Marelli became a holding company controlling all the auto-component firms. UFIMA (Union Fiat-Matra), under the presidency of Alessandro Barberis, was created at the same time. With a turnover of 8.3 billion francs, UFIMA makes two-thirds of Magneti-Marelli's total. Its products are instrumentation and fuel systems.

In the first category: instrument panels, wiring and switches. Jaeger, Veglia-Borletti and Cavis control 50 percent of the European market. In the second sector, that of carburetors and injection systems, Solex and Weber control 60 percent of the European market. For Magneti-Marelli, the goal is to close in on Bosch, the European injection leader.

Controlled 65 percent by the Italians and 35 percent by Matra, UFIMA is the kingpin of Fiat's setup. But the other operations have also been reorganized. An organization by product lines has prevailed. Electromechanics (starters, alternators, fans, plugs, etc.) are the responsibility of the new firm Industrie Magneti-Marelli (3.3 billion francs turnover). Climatization--basically air conditioners and heaters--is with Borletti Air Conditioning (700 million francs in business). Lighting is SIEM's territory (400 million francs), and electronics (engine feedback, ignition, regulators, etc.) is that of Marelli Autronica (325 million francs).

The restructuring of auto components at Fiat is not finished. The group's geography must undergo change. Thus, the brake operation was given to Bendix. Acquisitions could take place in the electronic-ignition sector, in which Fiat intends to expand.

For it is the electronics operations that are going to be favored. They will enjoy 25 percent of the total research and development budget this year. Magneti-Marelli is in a hurry. Though it got started in fuel injection just 18 months ago, Alessandro Barberis has just revealed that, in 12 to 18 months, the firm will be producing anti-wheel-lock systems.

Up to the present, most of the components made in the different plants have been used within the Fiat group. This is going to change. Thanks to the arrival of Jaeger and Solex, Fiat's share is going to become a minority one, at 40 percent. Peugeot and Renault will represent around 20 percent, and the other manufacturers 40 percent.

The Jaeger and Solex takeover thus represents a major step in Fiat's auto components surge. For scale economies are going to work in its favor, as they did in the case of Valeo. On one condition: that the realignment of product lines among the plants achieves quick results. Growth is fine; cutting costs at the same time is better. In the auto-components sector, this has become a necessity.

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LEVY TO RECAPITALIZE MAIN RENAULT SUBSIDIARY RVI

Paris LE MONDE in French 28 May 87 p 31

[Article by Claire Blandin: "Renault Heads for Privatization"]

[Text] "The end of this May brings a big change for Renault," affirmed Mr Raymond Levy, Renault CEO, at the close of the board meeting of Tuesday, 26 May. One after the other, within one week, the nationalized automobile complex had closed two "big cases," thus clearing its deck a bit more. After long negotiations, the cession of Renault's share (46 percent) in American Motors Corporation to the American firm Chrysler was approved on 19 May (LE MONDE 22 May). On 26 May the nationalized firm's chief presented to his board the plan for recapitalization of Renault Industrial Vehicles (RVI), designed to assure the autonomy--backed up with financial reserves--of its main industrial subsidiary.

Of course the cession of AMC seems to be the more spectacular decision, if only because of its political dimension (the CGT has always been critical of this American investment) and its emotional dimension (Renault was trying for the last time to gain entry into the world's biggest market). But at bottom, the RVI recapitalization represents a more "revolutionary" event. For the first time at Renault, there was talk of "partial privatization."

Who would have dared to imagine this 2 years ago, when Georges Besse was taking over as Renault's president? The group registered losses of 12.6 billion francs in 1984. The ouster of the preceding CEO, Bernard Hanon, in January 1985 put an end to the system of co-management with the CGT, and seemed at the time to be fraught with every sort of conflict. Renault was still a symbol for everyone. No one would have suspected a birth of private-enterprise thinking in a group so burdened by its relations with the government and by its role as a social policy showcase.

Renault's thinking is in the process of changing. Who could deny this in the light of the AMC and RVI cases? To hear Mr Levy tell it, the American investment made by Renault in 1982 was a typical action by a firm living beyond its means. "Renault did not have the technical, legal or financial resources for it." Everything that was invested in AMC had been borrowed, making this subsidiary into "a time bomb." But an enterprise whose stockholders is the government could have continued to run this risk. Such has not been the case. And the arrival, in March 1986, of a government claiming to be "liberal" is not the essential cause.

"Follow the Subsidiary's Path"

Since his arrival at the head of Renault, Georges Besse had applied the same reform methods as in the private sector: management efficiency measures, personnel cuts, withdrawal from peripheral operations.... Pressure from a stockholder government pinched by a tight budget could only subserve this policy of his.

Mr Levy has followed in his footsteps. The management of the RVI recapitalization is another demonstration of this. And the nationalized firm's new boss attached all the more importance to it because he desires to see the group "follow the path of its biggest subsidiary."

The heavy-duty-vehicle manufacturer is proof that reform is possible. Despite a stagnant market, permanent overcapacities, and the price war that results from them. After its descent into the hell of 1982-1983, RVI has conscientiously and steadily risen gain, with successes cumulating quarter by quarter. "The first half of 1987 will be the seventh 6-month period of improvement," concludes Mr Philippe Gras, RVI's CEO, today. In 4 years, the breakeven point (the production level above which a manufacturer makes money) has been cut by more than half, going from 80,000 trucks in 1984 to 37,000 in 1987.

Having proved its ability to keep its promises, RVI finds itself endowed with financial resources such as it has never before had, with a capitalization of 4 billion from its stockholder, but also with the support of 3 major banks: the Societe Generale, the Banque Nationale de Paris, and the Credit Lyonnais.

This broadening of RVI's capitalization for the first time breaks into the traditional closed-circuit financing mechanism based on government funds.

The Final State Subsidy

True, the 3 "old ladies" are still nationalized. But the government's privatization program will not spare them. Societe Generale's return to the private sector is already scheduled. Their participation in RVI's capitalization, besides the signal it gives of confidence in the future of the heavy-duty-truck manufacturer, constitutes a partial, anticipated privatization of one of Renault's subsidiaries (and not the least of them), because, in the long run, 30 percent of RVI's capital will end up in the hands of stockholders other than the parent company.

The concept is that the banks will trade their potential shareholdings on the exchange. Henceforth, therefore, RVI will be faced with the prospect of market discipline. All the more since its parent company is in hopes of having given it the means to operate autonomously, and wishes "to hear no more of it."

What happens to RVI could well prefigure Renault's future. First in terms of reform, even if some objectives are made harder to achieve by the size of the overall group. Productivity gains of the order of 10 percent take on an entirely different dimension with a workforce of 186,500 (as against

RVI's 19,000 at the end of 1987). Not to mention the wage handicap which Mr Levy never stops denouncing, whereby Renault's personnel, with the same jobs, are paid 15 percent more than those of its private competitor, Peugeot.

Then again, in terms of the reconstruction of its own capital--for this is the problem the nationalized firm's staff is now going to tackle. With a net loss position of about 7.3 billion for the group, and of 16 billion for the entire nationalized entity, the car manufacturer will certainly not get out of trouble without the government's help. But the solution will probably not be by way of an outright grant of capital by the single stockholder. There is no reason to think that an arrangement like RVI's would not be applicable to Renault, or to certain of its operations. There is nothing against it. As long as Renault is able to propose as solid a 3-year plan as that of RVI. "The year 1990 has to look clear and sunny to me, so that I can tell the government, 'If you straighten out Renault's financial situation today, Renault will have no more problems with the future.' This is not yet the case."

[Box, p 31]

A Tiered Structure

The structure of the RVI recapitalization must still be approved by the stockholders meetings of RVI and Renault. The capitalization of 4 billion granted to the subsidiary by the parent firm will take place in three installments after the meetings to be held on 30 June.

A first 1.2 billion capitalization will take place on that date. It will bring the net capital position to the zero point. RVI's stock will thereupon be split 10 for 10. Renault will then make a second injection of capital of 1.6 billion francs, brining RVI's capital position to 1.7 billion. The third injection, of 1.2 billion, will take place at the end of 1987. Part of these capitalizations (about 2 billion) will be used to buy up the shares of Mack, the group's American heavy-duty-vehicle subsidiary. These will be transferred from Renault Holding to RVI.

The bank participations of 1.2 billion (400 million for each of the 3 "old ladies") will take the form of lines of credit against stock warrants in the cases of Credit Lyonnais and Banque Nationale de Paris, and will take the form of advances against warrants in the case of the Societe Generale. These warrants, which can be exercised within 5 years and 3 months, will over time permit a capitalization amounting to 30 percent of RVI's capital.

The RVI plan is based on 2-year cumulative consolidated before-tax earnings for RVI and Mack of 1.8 billion francs, and, for the third year, on a profit 10 percent higher than that of the better of the 2 years in question.

If the plan is not carried through, Renault will buy up the warrants, RVI will repay its line-of-credit drawings and its confirmed loan, and the banks will recover their capital complete with a yield approximating a guaranteed percentage. If the plan succeeds--and Mr Levy envisions no other possibility--the banks will subscribe capital by way of their warrants and will then dispose of their shares on the exchange, the registration of the securities taking place in 1992 at the latest.

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DENMARK: INDUSTRY CRITICAL OF BIOTECHNOLOGY POLICY

Duesseldorf HANDELSBLATT in German 15-16 May 87 p 24

[Unattributed article: "Industry Criticizes Genetic Engineering Policy"]

[Text] Copenhagen--By the year 2000 products of genetic engineering could represent about 15 percent of Denmark's total industrial and agricultural net product. But parliament and the administration are standing in the way of the "Green Revolution" by allowing and furthering the basic research but blocking commercialization, the Federation of Industries in Copenhagen complains.

It points to the example of a genetically-engineered sugar beet, reprogrammed in its genetic makeup, which has been developed by the DDS sugar group in the laboratory but which, under the genetic engineering law of last year, may not be tested in the field. The new beet has greater resistance to plant protective agents than hitherto existing types, and therefore stronger agents in smaller dosage can be used. According to DDS, that results in cost advantages for the farmers and a decrease in stress on the environment because the new agents rapidly decompose, and also simply because they can be used in smaller amounts.

For almost a year the Danish biotechnology industry has been waiting for the genetic engineering law's implementing regulations, in which the safety regulations are to be established and defined. The Labor Protection Office's first drafts were, in industry's opinion, so restrictive--complete isolation, a change of the personnel's smocks every quarter hour--that in fact, it would have stopped genetic engineering research. In any event, that would have been the case within the confines of Copenhagen University, as its rector, Ove Nathan, explains.

Danish industry points to the fact that at present in the United States a softening of the National Institute of Health guidelines for genetic engineering experiments is occurring because the institute is convinced of the harmlessness of the microbes used. It is also noted that the first field test with genetically altered bacteria was started in the United States in April.

A new draft by the Labor Protection Office brings the Danish regulations closer to the American ones, but more in the area of research than for production. Mads Ovlisen, head of the biotechnology group Novo, recently warned that the Danish special provisions, with their safety regulations which are more stringent than those under which competitors work, could result, in the worst case, to research and production being transferred abroad. The largest enterprises in the trade have already made the requisite preparations for such an eventuality.

The two researchers Torben Ruse and Jorgen Lindgaard have formulated an expert report for the National Technology Commission, according to which the result of genetic engineering production for the country's three leading development enterprises--Novo (insulin), Nordisk Gentofte (growth hormone) and Chr. Hansens Laboratory (cheese laboratory)--equates to one-sixth of turnover. The value of the three enterprises' production is today some 6.1 billion Danish kroner (DM1.6 billion). Instituting genetic engineering production would achieve savings of 145 million Danish kroner in raw materials and 70 million Danish kroner in production, to which must be included a market profit estimated at 100 million Danish kroner and the prevention of a market loss of 710 million Danish kroner.

In relation to the whole area of Danish industry and agriculture, the results of genetic engineering amount to between 3 and 5.5 billion Danish kroner. That equates to 2 to 3 percent of net product. And in the year 2000, the two researchers project, the net product in the area of genetic engineering will amount to 20 to 30 billion Danish kroner in today's prices, and thus account for about 15 percent in the overall industry-agriculture area.

But these prospects will not be realized if the industry drifts away overseas. In a certain sense, DDS has already taken this route. The University of Nottingham was the partner in the development, by cell fusion between traditional rape and mustard, of a new rape variety which is not self-pollinating and therefore less susceptible to inbreeding phenomena, and field tests with the new plant are to take place in England because a dispensation from the Danish ban on such experiments has not been obtainable to date.

DDS would like to clear the way with the rape application in order to make subsequent procedures of this kind easier, whereby the enterprise has the newly developed sugar beet in mind. But the new rape variety is economically interesting taken by itself because the yields can replace imports of rape-oil and feedstuff. Pending further developments, it can only be examined in England. There is a ban on bringing it into Denmark.

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FRG SCIENTISTS CONSIDER GENETIC ENGINEERING RISKS EXAGGERATED

Duesseldorf HANDELSBLATT in German 14 May 87 p 6

[Unattributed article: "Genome Analysis Can Increase Therapy Chances for Genetically Determined Diseases"]

[Text] Bonn (DPA)--The German Research Association (DFG) regards the risks seen by the Bundestag commission on "Opportunities and Risks of Genetic Engineering" in genetic engineering experiments to be exaggerated. In the light of all experience to date, such experiments represent "a danger," according to a comment on the report of the Bundestag commission of inquiry.

The responsible DFG senate commission has emphasized that experiments have been conducted in this field on a worldwide basis for 15 years in more than 10,000 laboratories now, "without a single case of the endangerment of experimenters, or of the environment, having ever become known." In view of the finding of the commission of inquiry, it is to be feared that parliamentary deliberation isolated from technical-scientific reality could lead to regulations which would seriously hinder science and saddle it with expenses, without being necessary and significant.

The commission of inquiry's call to embody the existing safety guidelines for genetic engineering work in government-subsidized institutions in a comprehensive law, is rejected.

The restriction of research work in the genetic engineering field is accepted to some degree by the DFG. Thus, its senate commission approves of the ban on introducing genetically-engineered material into the human gene pool at the present time. On the other hand, an absolute moratorium on releasing microorganisms altered by genetic engineering is not supported. Although the senate commission indeed still considers it proper to categorize ecological risks, there must nonetheless be a possibility of empirically investigating them.

The DFG takes a critical view of the recommendations of the commission of inquiry regarding the matter of genetic examinations (genome analysis) in humans. To be sure, it acknowledges the concerns about data protection and the citizen's personal freedom to make decisions about his genetic data, but nonetheless it is the duty of science and in the interest of ill people to shed light on genetic defects in order perhaps to make them treatable in the future. Above all, the commission of inquiry fundamentally rejected--just as the unions had done previously--the use of genome analysis for mass screening of employees.

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FRENCH EVALUATION OF JAPANESE BIOSENSORS

Paris BIOFUTUR in French Feb 87 pp 64-65, 67

[Article by Silvia Vaisman: "Biosensors in Japan"]

[Text] Biosensors, which go back some 15 years, very quickly became an attractive and highly promising idea. Based on the joining of a biochemically active compound (fixed on a support and capable of specific identification of a target substance) and an electronic system which transforms the compound's activity into an electrical signal, biosensors are experiencing intensive international competition. The market, however, is only in its infancy. The major attractions of these measurement instruments are, first, their specificity (Footnote 1) (Narrow specificity: L form of a given amino acid, L or D glucose. Broad specificity: L form of any amino acid, or recognition of physiological modifications of the target of a neurotoxic substance (an acetylcholine esterase biosensor, for example) but also their high degree of sensitivity (detection on the order of 10 ppm and precision around 5 percent), the possibility of producing them in miniature and automated form, and their rapid detection speed (response time ranging from a few tens of seconds to a few minutes).

If we consider the number of papers published and industrial achievements, there is no doubt that Japan is by far the leader in this field. It is true that in conquering this new world market--estimated at more than Fr 10 billion (Footnote 2) (The European market is said to have amounted to Fr 4 million in 1986. If the forecasts prove correct, it will be worth more than Fr 60 million in 1990, not including military gas biodetectors)--they have benefited from two considerable advantages: great experience in electronics and being the first country to have equipped their fermenters with electrodes using enzymes or immobilized microorganisms.

Based on the work of Isao Karube (Footnote 3) (Professor of biotechnology and bioelectronics at the Research Laboratory of Resources Utilization of the Tokyo Institute of Technology), Japan developed after 1974 one of the first biosensors which was used for the detection of hydrogen peroxide in food (this compound is a by-product of glucose oxidation). Several years earlier, however, S.J. Updike, an American, had attached an enzyme to an electrode by using a polyacrylamide gel. This gel was far too fragile for the concept to be viable as an industrial process. I. Karube took over this idea and made it

his own. He invented a membrane strong enough to resist the "shocks" of industrial production, but fine enough to be sensitive to electrochemical modifications in the surrounding medium. Enzymes could also be attached to it.

Today, in addition to I. Karube's laboratory, the important Japanese Technological universities are studying this subject: Professor Aisawa of the Tsukuba University is trying to develop a cost-effective system for energy transduction with oxide-reducer enzymes. He is also addressing new immobilization techniques and the use of immunological systems (essentially monoclonal antibodies) for the biochemical compound element of the biosensor. Dr Inakuchi of the Okazaki Molecular Biology Institute is also studying the use of electron-accepter biological compounds, in particular the cytochromes, whereas Dr R. Tsubomura and Dr N. Yamamoto have tended to direct their research towards the improvement of immuno-electrodes. Moreover, there are almost 50 Japanese companies that are more or less interested in this promissing new market (see table).

In industry three sectors appear to be particularly interested in using biosensors: the medical sector (in hospital or home environment for on-the-spot check-ups for example), the industrial sector (to provide almost constant monitoring of production processes, which could accelerate their access to automation), and, finally, the environmental protection and monitoring sector.

Biomedical Applications

The first sensors which attracted attention were used for the measurement of glucose in blood or in urine, a vital analysis for the diagnosis of diabetes.

Many companies in Japan are already marketing biosensors: Analytical Instruments since 1982, Toyo Boseka since 1983, Fuji Electronics, Kyoto Daiichi Kogaki, Mitsubishi Chemicals, Technicon, Toadempa, and Yellow Springs Instruments.

For the detection and prevention of arteriosclerosis, the improvement of techniques for measuring lipids in the blood remains a top priority. For this purpose, Dr Iwao Tafuku (Kyoto University) has developed a new type of biosensor for cholesterol which detects concentrations as low as 0.1 mg per 100 ml, i.e., 1,000 times less than the rate of blood cholesterol. The electrode is made of a tin rod covered by a special membrane (the Langmuir-Blodgett membrane) the surface of which is pierced at regular intervals. The pores are the same size as cholesterol molecules. Prior to making a series of measurements, the electrode is immersed in a solution rich in vitamin K or chlorophyll. These small-diameter molecules lodge themselves in the membrane perforations. The electrode is then plunged into the serum to be studied. The cholesterol molecules then displace the smaller molecules and this displacement generates a decrease in the current proportional to the concentration of serum cholesterol.

Another big opportunity for biosensors in medical analysis is lactic acid measurement. In this area Tateishi Electric Co. and Toyobo Textile Co. have cooperated to develop a sensor (Footnote 4) (Made of a film of oxydase lactic acid and a hydrogen peroxide electrode) capable of measuring the amount

of lactic acid in a 100 microliter sample of whole blood in 80 seconds. (Note that conventional measurement methods take from 15 minutes to 1 hour for the same measurement.)

The various enzyme sensors, mentioned previously, were designed to provide the best possible detection of a specific chemical substance. In addition, sensors capable of simultaneously measuring several compounds have also been developed: the multifunction sensors. The best known of these is still the NEC sensor. This sensor is able to measure the concentrations of urea, glucose, and potassium (the response times are 20 seconds for potassium, 30 seconds for urea, and almost 2 minutes for glucose using a single drop of blood.

The quantity of a given antigen represents yet another essential measurement in the biomedical sector, particularly following a clinical test, for example. Based on this established fact, a research group at the Tokyo Technology Institute has developed a new biosensor concept, the "luminescent biosensor." A first experimental model was developed for the detection of albumin: When the albumin tagged with pyrene reacts electrochemically on the platinum electrode, a luminous signal is generated. This signal decreases strongly when anti-albumin antibodies are added to the medium. Thus, one simply adds a known quantity of antigen mixed with pyrene to the solution to be analyzed followed by a fixed amount of the corresponding antibodies. A conflict then ensues between the molecules of marked antigens and the unmarked molecules. The antigen concentration is therefore easily measured because it is in direct proportion to the luminous signal. The biosensor is sensitive down to 1 microgram per ml.

Finally, the latest generation of biosensors appeared in early 1986 as a result of close cooperation between I. Karube and the Seiko Denshi Kogyo Co. Using acoustic waves the biosensors detect the level of pathogenic bacteria in an organism. For this the specific antibodies of the targe. bacteria must be joined to small quartz oscillators. The bacteria interact with these antibodies and combine with them, which considerable increases the oscillators' load. Therefore, their movement is slowed down.

Industrial Sector Applications

A wide variety of biosensors is needed in the agro-food industries. The strong arrival on the market of these measurement tools has addressed a specifically Japanese problem: the exact analysis of freshness of "Sashimi" (raw fish). Among all the elements produced by decomposition, only three of them need be measured to obtain a good freshness reading: inosinic acid, inosine, and hypoxanthine. A multisensor detecting these three compounds has been connected to a computer to provide the most exact measuring instrument possible--where the freshness of the fish is registered immediately.

The flavor levels of foods can be evaluated by measuring the glutamic acids (used widely as a food additive) and nucleic acids. Several families of multifunctional biosensors satisfy this demad. Several of them are of the microbic type and use, as their biochemical system, color bacilli which consume the glutamic acid and give off carbon dioxide. The joining of these

immobilized microorganisms on a membrane and a carbon dioxide electrode was the starting point for the development of these sensors at the Saitama University (sensors for antibiotics or for vitamins are planned using the same principle).

The Toyobo company has developed a "biochip" which permits measurement of the degradation of casein during the manufacture of cheese. Immobilized aminopeptidases and amino-oxidases are protected by a semipermeable membrane which only allows the smallest peptides to pass through, specifically those resulting from casein degradation. The electrode measures the level of hydrogen peroxide produced after the action of these two enzymes, a rate proportional to the quantity of small peptides passing through the membrane.

It its own research laboratory Mitsubishi Electric has invented a biosensor for quality control of oils and greases. It consists of two field effect transistors. The lipase degrades the lipids to be tested which modifies the hydrogen ion concentration close to the lipase fixation membrane. This concentration is compared with the one measured by the second transistor. Sensitivity is reportedly on the order of 9 mg/l and this type of sensor would last 50 days.

A growing number of companies are interested in alcohol biosensors. Alcohol is not only a raw material for several industries and an important consumer item (essentially sake), but ethanol is also the focus of a national program of industrial production for use as a fuel. Five companies are very interested in this: Yellow Springs Instruments, Denki Chemical, Nisshin Denki, Kirin Beer, and Asahi Beer (the last two companies are still developing their sensors).

Finally, it should be noted that for strategic reasons many Japanese companies (Ajinomoto, Kyowa Hakko, etc.) are developing their own sensors, which they use to monitor their fermentation and cel culture processes.

The Environment and Environmental Monitoring

Microbic sensors, uniting microorganisms (usually colon bacilli) and a metabolite detector electrode, are particularly well suited for the measurement of pollutants in the environment. They are stable over a long period and the costs of analyses are considerably reduced by their use sensors. This latter point is very important in a financially sensitive sector.

In 1983 Nisshin Denki introduced on the market a BOD (Biochemical Oxygen Demand) biosensor specializing in environmental surveillance, specifically the chemical aspect.

Oriental Electronics is selling an analysis sensor for fresh water. This instrument accurately measures the content of dissolved oxygen, which is higher because there is so little organic material in the water.

In addition, the Japanese Ministry of Construction is partly subsidizing Isao Karube's laboratory to help develop a biosensor for the automatic and permanent monitoring of pollution levels in rivers.

Establishing close cooperation between university staff and industrialists has enabled Japan to establish a firm foothold in the developing biosensors market. Their strongest point has no doubt been the ability to move quickly from research to the development stage, particularly in the medical and industrial processess sectors.

Table. Biosensors Marketed or Under Development in Japan

Company	Area of Application Technical Aspects	Target Compounds	Status
Analytical	Clinical Diagnosis	Glucose	marketed since 82
Instruments (1)	Fermentation	Glucose, ethanol, lactic acid	marketed
Toyo Jozo (2)	Agri-foods	Glycerol, Glucose, etc.	marketed since 84
Fuji Electronics	Clinical Diagnosis	Glucose, urea, uric acid, amylase	marketed under development
	Brewery	Glucose	marketed
Fujisawa Pharm	Clinical Diagnosis	Glucose, urea	under development
Ishikawa	Fermentation agro-foods	Glucose	under development
Kyoto Daiichi Kogaki	Clinical Diagnosis	Glucose	marketed
Mitsubishi Chemicals	Clinical Diagnosis	Glucose	marketed
Nissoki	Artificial pancreas	Glucose	marketed
Oriental Electronics	Fermentation agro-foods	Glucose, food freshness	marketed
	Water analysis	Dissolved oxygen	marketed
Technicon (1)	Clinical diagnosis	Glucose	marketed
Shimazu Tateishi	Clinical diagnosis	Glucose	under development
Tokyo Boseiki	Clinical diagnosis	Glucose lactic acid	marketed since 83 marketed since 84
Toadempa	Clinical diagnosis	Glucose	marketed
	Fermentation	Glucose	under development

Company	Area of Application Technical Aspects	Target Compounds	Status
Tokyo Shibaura Electric	Clinical diagnosis	Glucose, urea	under development
Yokokawa Hokushin	Clinical diagnosis	Glucose	under development
Yellow Springs Instruments (1)	Clinical diagnosis	Glucose	marketed
	Fermentation	Glucose, ethanol	marketed
		Lactose	marketed
		Starch	under development
Denki Chem	Fermentation (immobilized yeasts)	Ethanol	marketed since 84
		Acetic acid	marketed since 84
Nihon Sharyo	Fermentation (immobilized yeasts)	Glucose	under development
Nisshin Denki	Fermentation (immobilized yeasts)	Ethanol, organic acids	under development
	Environment	BOD	marketed since 83
Kuraray	FET [field effect transistors]	pH, oxygen, carbon dioxide	under development
Mitsubishi Electronic	ISFET [ION sensitive FET]	Glucose and urea simultaneously	under development
NEC	ISFET with integrated amplifier	Glucose and urea and potassium simultaneously	under development
Tokyo Co.	ISFET	Glutonic acid	under development
Matsushita	Semiconductor	Glucose	under development
Mitsubishi	ISFET	ATP	under development
Seiko Electric	Thermistor	Glucose	under development
NEC/Yamasa	Microelectrode	Glutamic acid	under development
Fuji Electric	ISFET	Ammonium	under development
Lion	Microelectrode	Dextranase	under development

Kirin Beer	Microelectrode	Ethanol	under development
Asahi Beer	ISFET	Ethanol	under development

(1) American companies
(2) Toyo Jozo is developing biosensors for numerous parameters. The first one was for glucose.

(Source: R.D. Schmid, Biotechnology in Japan, 1985--Applied Microbiology and Biotechnology (1986) 24: 355-365).

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RESULTS OF EEC CVT-CAD VLSI PROJECT DESCRIBED

Munich INFORMATIONSTECHNIK IT in German No 1, Feb 87 pp 44-52

[Article by Wolfgang Borutzky and Klaus Woelken of the Association for Mathematics and Data Processing (GMD): "GMD's Contribution to the European Joint Project CVT-CAD VLSI for Telecommunications, Sponsored by the European Economic Communities, EEC"; figures not included]

[Excerpts] 2. Goal and Structure of the Project

The goal of the CVT project was the development of an integrated CAD system for designing VLSI circuits, especially in the realm of telecommunications, that supports all levels of the design process, from a description of the architecture to the drawing up of mask tapes through programs, that guarantees the consistency of circuit descriptions on the various levels of abstraction and guides the designer during the design process so that even less experienced designers are able to design their own application-specific circuits, thus meaning that the size of the group of people developing circuits grows larger. In addition, the CVT system should be flexible enough for various design styles to be easily adapted to it.

This joint European microelectronics project, the first one supported by the EC in the CAD area was sustained by three postal service research institutes:

CNET - National Center for Telecommunications Studies, Grenoble, France

CSELT - Center for Telecommunications Studies and Laboratories, Turin, Italy

FI/DBP - Research Institute of the German Federal Postal Service at the Telecommunications Center, Darmstadt, FRG

Besides these three main EC contract partners, systems houses and semiconductor producers, research institutes and universities from France, Italy and the FRG were involved in the project. Of the 28 participants in the project, West German contributions to the CVT project were made by AEG Telefunken in Ulm, SEL, the major research institutes GMD and FHG (IFT, Munich) and the universities in Dortmund, Darmstadt, Karlsruhe, Bremen, Kaiserslautern and Aachen.

The project ran from February 1983 to May 1986 and involved a total of 330 man-years and financial expenditures of 24 million ECU, 50 percent of which was borne by the EC.

The goals of the project were divided into the following four tasks, with an average of eight subtasks in each case:

--Architecture,

--Languages and Data Base,

--Testing,

--Device Modeling.

An addition fifth task was responsible for integration of the findings.

3. Hardware and Software Structure of the CVT System

3.1. Hardware Foundation

In establishing the hardware foundation for the CVT system, consideration was given to the fact that, at least among the project participants from industry and at several universities, a large number of CAD application programs for some time to come would be running on a VAX with the VMS operating system, while as a result of a decentralization trend in computer output the establishment of a spectrum of work stations using the Unix operating system as a standard has been emerging, especially for graphic, interactive tasks. For this reason, as Figure 1 shows, an Ethernet-LAN with a VAX/VMS host was chosen as a hardware foundation for computer time-intensive tasks, and work stations were given Unix as an operating system.

3.2. Data Retention

3.2.1. The CVT Design Data Base

The CVT software system is based on a reference design data base that is uniform for all application programs and that is installed on a VAX/VMS host. Tools used either on the host or at the work stations communicate with one another via the LAN by reading data from the reference data base or by delivering data to the data base management system (DBMS) for housekeeping. Besides other possible local data bases at the work stations, the reference data base system on the VAX ensures the integrative cohesion of the CVT system by offering uniform data retention for all application programs, with safety mechanisms for a crash situation and by making it impossible, for example, for two developers, after they have altered the logic plan of a circuit from the reference data base at their work stations, to rewrite these changes back to the reference data base simultaneously. In addition, a permanent data base model and the pertinent data base primitives are used to ensure consistency between connectivity on the logic level (network lists) and the layout level in a circuit design vertically across the design levels. The reference data base can clearly consist of several possible data bases (libraries), whereby

circuit designs can be copied from one data base into another. However, one task of a network file system is to support the export and import of circuit descriptions between local data bases at work stations and the reference data base in the host by way of file transfer. An exchange of data between various data bases is not possible at present. This means that although circuit designs can be kept in local data bases, they are to be transferred by the circuit developer to the DBMS in the host with the help of the network functions, in order to assure uniform data retention in the LAN. At present, this uses a blocking mechanism on all the cells whenever there are a number of simultaneous accesses of one cell of a circuit design.

3.2.2. Data Base and Application Programs

The simplified model in Figure 2 shows the COSMIC data base system developed by CNET (Grenoble). A data base management system (DBMS) manages a VLSI data base (DM) and makes available control mechanisms for data integrity, competitive data access and recovery routines. Data base interface service routines constitute an object-oriented procedural interface (DBI) between the data base management system (DBMS) and the application programs, whereby DBI routines are to be used to write a special interface for each VLSI design tool in which any errors reported by the DBI routines must be intercepted. There are no provisions for a query language.

The data base interface is added to a relational DBMS core made available by the University of Grenoble that was not specifically designed for VLSI applications, but which was improved by DNET and expanded in order to allow mechanisms for managing CODASYL rings.

3.2.3. The COSMIC Data Base Model

The data base interface routines start from a common, hierarchical, logical data base model that is preset by the data base administrator for all application programs and is depicted in Figure 3. Three levels can be distinguished:

- Librarian administration (librarian level),

- Structural circuit description (structural level),

- Graphic description (graphic level).

In the model shown in Figure 3, boxes signify the data base objects such as CELL, CELL DESIGN, VERSION, etc, while the arrows signify CODASYL rings. For example, the arrow designated DBVRR indicates that an example of a CELL DESIGN can be the owner of a DBVRR-type ring in which the various versions of this CELL DESIGN are kept.

The root of the entire hierarchical data base model is a cell library. Cells in the sense of circuits or partial circuits, such as multiplexers, shift registers, flip-flops, etc., are each a combination of various designs of a cell that differ in terms of technology, of the design methodology used or with respect to alternative implementation. A cell design is in turn a class

of cell versions. Finally, a version contains the description of a cell in a certain version (stage of completion), similar to the version concept of the VMS operating system with data files. Textual, structural and graphic cell descriptions are supported. (The data of the different forms of description are kept in various rings, whereby data is read in and out via so-called communication buffers, which are assigned to each data base object.) The performance and/or the structure of a digital circuit or partial circuit can be stored on the register-transfer level in the form of a textual description. For the structural layer, design objects such as components, cell input and output, component ports and line connections between components are supported, whereby cell entities in a cell under consideration are designated as components and cell ports at the components are designated as pins. A node is a group of pins of various components that are connected electrically. If an object that has not yet been validated is changed, then this has an effect on all entities (propagation). The objects of the structural description can in term have a graphic description that consists of polygons, symbols and text. In this way, block diagrams and layouts can be filed in the data base at each cell. The hierarchical, logical data base model thus takes into account a hierarchical description of circuit designs. However, no new objects and relationships between these can be defined by the user of the data base and added to the described data base model.

3.2.4. COSMIC Implementation

The COSMIC data base system consists of an ISO-Pascal of approximately 70,000 lines. It was implemented on both VAX/VMS and Apollo/Aegis and requires on the VAX approximately 200 kilobytes for code and data structures and 200 kilobytes buffer. The average access time on a VAX 8600 is around 10 ms.

3.3. User Interface

In using the CVT system, the designer is guided by a so-called monitor developed by CSELT which uses a top-down method to graphically illustrate to him at each design stage the correlation between the various programs and data and to show him possible ways of continuing the design process, while attempts to continue in other ways are rejected.

The overall CVT software system encompasses a series of tools for special areas of application, such as tools for the design of microprocessor architectures, digital signal processors or controllers. In addition, it enables the designer, depending on his wishes or on other demands, to describe a circuit either graphically or textually and to generate the corresponding physical layout either automatically, manually, or with the help of a symbolic description or a procedural language. Consequently, it is possible to define various configurations of design tools, in that particular tools are selected and their interdependencies are relayed to the design monitor. In this sense, the monitor, which is based on a Petri network design, is programmable, and the entire CVT system is extremely flexible in adapting to a special area of work or to a particular design method.

3.4. Design Tools

3.4.1. Architecture Description

As Figure 4 shows schematically, the CVT system covers the entire design process, from the description of the architecture to the generation of layout. To this end, a wide spectrum of CAD tools not shown in Figure 4 is needed. The most important of these are discussed below in summary.

Starting with a top-down statement, the hardware description of digital VLSI systems and simulation on higher levels of abstraction (response, register transfer, logic) are supported during the design of an architecture by programs such as DACAPO-II (University of Dortmund/Chair for Computer Science 1) as well as KARENE (IMAG) and KARL-III (University of Kaiserslautern). For the latter program, an editor ABLED was developed by CSELT for graphically inputting block diagrams on the register transfer level.

In addition, there are numerous programs available for the automatic layout generation of particular circuits. Thus, the Research Institute of the German Federal Postal Service (FI/DBP) has developed generators for creating cells such as shift register, counters, adders, RAMs and ROMs. In a cooperative effort by German and Italian universities together with the CSELT, a system was developed that automatically generates the layout for a final finite state machine (FSM) in a gradual fashion on the basis of PLA architectures. Finally, the Technical College of Darmstadt has provided a silicon computer, ALGIC, for digital signal-processing circuits.

3.4.2. Placement and Wiring

Starting with the Karl-III description of a system--a hierarchical breakdown into functional blocks and a determination of correlations between the blocks--the interactive system developed by CSELT, ARIANNA, makes it possible to position and wire the blocks, whereby the designer can preset values or intervene in the case of undesirable results. On the other hand, the system is aware of rules that must be observed during layout design. In addition, ARIANNA is capable of checking coherence between the structural and the physical layout description. ARIANNA was implemented at the Apollo/Aegis work station.

3.4.3. Circuit Simulation

The electrical response of cells or smaller circuits can be simulated through the CVT program by the DOMOS program, which was further developed by the IMS (Institute for Microelectronic Structures) of the Fraunhofer-Gesellschaft (FhG) in Duisburg. Like the well-known Spice program at the University of Berkeley, the expanded DOMOS permits the analysis of both analog and digital MOS circuits, as well as those with bipolar transistors.

Because of the time-variant topology of switch-condenser networks, classical circuit simulators such as Spice and DOMOS are not particularly well-suited for studying circuits and switch-condenser filters. The IMS thus developed the program DOSCA for electrical, non-linear simulation, and the program DIGIT

for an initial, rapid and less accurate analysis of the flow of signals from time-invariantly sampled networks.

3.4.4. Layout Generation

Various methods are supported in the CVT project for generating layout. A layout editor by the Institute for Solid-State Technology (IFT) in Munich permits the manual preparation of physical layouts on 41xx-series Tektronix terminals. Particularly notable in this layout editor is a built-in, rapid on-line design rule checker, which examines all changes in an internal data base in the background during the preparation of layout. Violations of design rules are displayed immediately and explained where necessary. The editor has at its disposal both an interface to the CVT data base COSMIC and a CIF interface.

A symbolic layout description (sticks) for cells that do not contain any subcells (leaf cells), automatic conversion into a fully expanded layout, and subsequent compactization are made possible by the SYMBAD package, developed by the company SGS. Layouts generated in this way differ from hand layouts in that although they are error-free, they cannot generally compete with manually designed layouts in terms of use of space.

Finally, the layout of a circuit can be described textually using a procedural language developed by the Technical College of Darmstadt, SELLAV, and from this be generated automatically using the SELLAV compiler. The method of operation here is to symbolically describe base cells--thus, cells that have no subcells--and to procedurally describe the generation of the overall layout from cells that can in turn contain cells. In this way, a hierarchical top-down and bottom-up design method is supported.

Non-hierarchical layouts with orthogonal structures (Manhattan layouts), once generated, can be adapted to new design rules that involve the very same technology, such as CMOS, using an integrated program in the FhG layout editor, so that an integrated circuit can be easily designed for process lines by various manufacturers.

3.4.5. Circuit Recovery

In order to ensure that a designed layout still corresponds to the original functional circuit description at the beginning of the design process, it is necessary that the circuit be extracted from the layout and that the logical behavior, including the time delay of signals caused by gates and lines, be verified at least one more time. To this end, AEG in Ulm developed two programs for extraction of logic connections between the gates of a hierarchical, cell-based layout description and for the calculation of resistances and capacities that are to be assigned to a logic node and that cause signal delay. On the basis of this information, it is subsequently possible--with AEG's DISIM simulator, for example--to study the logic and timing behavior of a circuit in the post-layout phase.

4. Contribution by the GMD

With the availability of large numbers of the Motorola MC68000 microprocessor at the beginning of the CVT project, it became quite apparent that the implementation of interactive VLSI design tasks in particular would in the future shift increasingly to work stations with the Unix operating system, with increasing local computing power at the workplace of the development engineer and at the same time falling hardware prices. This trend was taken into account in the CVT project with the definition of the LANs described above as a hardware foundation for the CVT software system, whereby the work stations in the CVT project--based on the state of technology at the beginning of the project--were to feature a Unix operating system, calculating power of around one MIPS and main memory of at least one megabyte. In keeping with this, the GMD was involved in the CVT project with a subtask "Design Tools for a Personal Work Station," whereby PCS's Cadmus/MUNIX computer and a Tektronix Tek4109 color graphics terminal was selected as a work station after a market evaluation in the summer of 1983, the goal being to develop an open design environment for customer-specific circuits in the GMD based on a general purpose computer.

4.1. Unix-VMS Computer Coupling

Because of the LAN hardware foundation foreseen for the CVT system and depicted in Figure 1, the GMD took on as its first task--after the adaptation or development of VLSI design tools--the realization of a mains connection based on Ethernet between the VMS operating system and a Unix not restricted to the variants of a particular supplier. To this end, a new type of DECnet emulation on the Cadmus/MUNIX was implemented by the Thomas Pahl data processing consulting firm within the framework of a cooperative agreement between the GMD and PCS; this system was tested by the GMD and has since then been successfully marketed by PCS as the Cadmus/DECnet. For internal purposes within the GMD, the DECnet emulator was also ported on a VAX750 with the Berkeley Unix 4.2bsd. operating system, thus demonstrating the highest degree of independence of the hardware and the Unix variants by a particular manufacturer. The planning and implementation of this new type of DECnet emulation has already been made public on numerous occasions. For this reason, further details will not be discussed here.

4.2 Circuit Design at a Work Station

Beyond network integration between work station and host, "Tools for a Personal Work Station" also involved focusing on the development of a design rule checker, which will be discussed separately below. Moreover, the adaption of programs, which thanks to CVT partners as well as others were made available or acquired for non-commercial use in the GMD, made it possible to support nearly all design stages at the selected work stations through the software. Figure 5 shows the layout of the design process, together with the corresponding installed software tools. As this figure shows, there are still very few interfaces between the individual programs. For the tools for geometric design, CIF (CalTech Intermediate Format) is the common data format, whereby DECnet emulation and conversion programs on the VAX provide the

connection to the CVT data base. This type of link is at present still lacking for the simulators.

4.3 Hierarchical Layout Checking

Besides the DECnet emulator, the GMD made another important contribution to the CVT project through the development of a hierarchical design rule checker (HDRC), which conducts off-line checking of hand-designed layouts for correspondence with geometric design rules established by the production process and in so doing makes use of a hierarchy in the layout description, insofar as it is available, in order to save computing time. Because this newly developed verification program has thus far been presented only at CVT open workshops and at the 1985 "Fifth International Conference on Custom and Semi-Custom ICs," in London, its basic idea and principal functional process are to be discussed below in greater detail.

4.3.1. Motivation

Because of the fact that technology makes it possible to produce integrated circuits with a continually growing number of transistors, it is today no longer unusual to have layouts with approximately one million geometric figures. For the design process, this trend leads by necessity to a situation in which layouts are increasingly developed hierarchically in a bottom-up procedure, whereby cells that have already been designed and that in general themselves contain cells are used repeatedly. As far as checking these hierarchically described layouts with respect to correspondence to geometric design rules is concerned, most commercial design rule checkers have thus far ignored the hierarchical structure in that they assume a fully expanded layout. Computing time for checking layouts with one million or more figures can thus easily lie in the range of several hours to several days. In contrast, the use of hierarchical description together with attention to regular structures can lead one to expect a significant savings in computer time, despite the associated overhead. This means that it is useful to conduct only one check of the internal structure of a cell that is used several times, as well as of any repeatedly occurring placement of two cells A and B relative to one another, and to apply this principle to every level of the hierarchy. It is easy to imagine that in a memory area, for example, the number of geometric figures to be checked is thus reduced to a minimum. (If the arrangement of two cells relative to one another is repeated but various overlaps with local figures of the overriding cells do occur on a case-to-case basis, then all overlaps of two cell entities must be checked separately.) In addition, layout checking based on the hierarchical structure results in a sharp reduction in redundant error messages.

One of the first software implementations of this idea was a filter that was developed at the California Institute of Technology in connection with work being done on a thesis. This program is a preprocessor for standard design rule checkers such as that by NCA, which starts with the CIF description of a layout and eliminates redundant geometry information as much as possible. The thus filtered, expanded layout is subsequently checked by the DRC. If there are no errors here, it is assumed that the output layout is also correct.

This arrangement allows a reduction not only in computing time, but also in the main memory space needed by the DRC.

4.3.2. Principal Functional Process of the Hierarchical Design Rule Checker

The DRC developed by the GMD in connection with the CVT project is similarly based on the idea of avoiding the checking of redundant geometry by using hierarchy and regularity. However, a different course was taken in implementation than that used in the filter program. In the two-stage DRC, the CIF description of the layout is processed bottom-up by a parser in a pass 1, and in this way suitable data structures in the main memory as well as various temporary data files are positioned. (Conversion programs take care of the link between the HDRC and the CVT data base.) In an subsequent pass 2, the layout is checked top-down by using the information provided by pass 1. This is explained in greater detail as follows:

For pass 1, the total layout is first broken down into partial layouts, and all polygons become rectangles. After a cell definition has been read completely, a minimal rectangular edge, the so-called bounding box (BB) can be easily indicated. This box is reduced by a figure based on the largest interval rule to a contracted bounding box (CBB), and all the rectangles of a cell that intersect the internal edge of the CBB are combined into an amount designated by a cell footprint. Assuming that the overlap of a cell with an adjacent or with elementary polygons of the overriding cell is limited to the cell frame defined by the bounding box BB and the contracted bounding box CBB (simple cell overlaps), it is obviously sufficient after a single, complete checking of a cell to use the positioned footprint of the cell instead of the complete cell entity to study the embedding of cell entities in their respective environment. This means that all intervals between a footprint element and adjacent, external rectangles are to be checked. The fact that rectangles intersect the edge of a footprint does not necessarily mean, however, that there is a design error. It could be the case, for example, that no footprint elements are projecting into the segment in question.

The terms bounding box, contracted bounding box and footprint introduced here are again depicted graphically in Figures 6a and 6b, using the example of a CMOS-NAND gate with two inputs. In a case where rectangles or the edge of a cell intersects the internal edge CBB of a positioned cell from outside (complex overlaps)--see Figure 6c--an algorithm was developed, which has been described, but not yet implemented.

After this preliminary explanation of terminology, the method of operation of the design rule checker can be detailed, using a simple example in Figure 7. The total layout is designated as "root" and contains, in addition to a polygon distinguished in the example by shading, two cells A and B. This in turn contains elementary cells: two cells C in A and D in B. After reading the CIF description of the layout, the footprints of the cells are known. In a first step, possible overlaps of the positioned footprints A and B in the "root" cell are checked in relations to one another and with the elementary polygon of the "root" cell. In a second step, cells A and B are studied alone one hierarchical step lower. Instead of the subcells, their footprints are positioned, and possible interactions are checked. Finally, the elementary

cells C and D, the leaves of the hierarchical tree, are studied. The complete check of the layout's "root" is thus completed.

Special regular structures, which are developed exclusively with the help of a base cell positioned in many places, are recognized by the existence of a clear relationship between the transformation matrices of two horizontal (for example), adjacent cell entities. Such regular structures could be memory or multipliers, for example. In this case, the matrix-shaped arrangement of cells is replaced by a bounding box in which only the footprints of four adjacent cells are positioned in the upper left-hand corner. In order to check the whole area, it is sufficient to check the thus filtered layout and the base cell.

The design rule checker described here is currently in a test phase and has been made available to several CVT partners for non-commercial purposes.

12271
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BELGIAN PARTICIPATION IN ESPRIT SOFTWARE PROJECTS

Zellik TECHNIVISIE in Dutch 18 Mar 87 pp 1, 8, 9

[Article by Eng A. Calders: "Data Processing: High-Tech Software"; first paragraph is TECHNIVISIE introduction]

[Excerpt] Talking with the computer in a natural language is still just a dream. Nevertheless, completion of ESPRIT project 107, "LOKI," brings it closer to reality. A second version of a natural language interface prototype has been created in the above-mentioned ESPRIT project. This version has a limited vocabulary suitable for a narrow field of business. Although such research is done mostly by universities, in this case a private Belgian company has taken on a large part of the research. A high-tech portrait of BIM [Belgian Institute of Management].

Prolog Developments

The R&D department is an important division at BIM. It has 12 of the 47 employees. The R&D department was established in November 1981 when Eng R. Venken, now head of R&D, was hired by BIM. Research focuses on advanced areas of computing technology, in part through participation in Belgian and European projects (with financial support from the IWONL [Institute for Scientific Research in Industry and Agriculture], the DPWB [Science Policy Programming Services], and the European Commission).

One of these projects, for the development of professional Prolog tools, was funded by the Science Policy Programming Services. The project has already yielded a number of marketable packages. It arose from the observation that Prolog tools developed at universities usually remained at an experimental stage. They could thus not be used for software tool development, the purpose for which BIM had created its R&D group. Prolog is a very powerful software language intended for the development of artificial intelligence [AI] applications.

Aside from Quintu (United States) only BIM has already developed such commercial Prolog products as a compiler and programs for translation into C, Fortran, Pascal, and Assembler. This year BIM hopes to achieve sales of 10 million Belgian francs, or one-tenth of their added value, from these products.

Artificial Intelligence

Prolog products are used in the development of expert systems. A trend towards developing AI shells (software programs which form the basis for AI applications, such as expert systems) is therefore likely. An application for a EUREKA project in this area is in preparation.

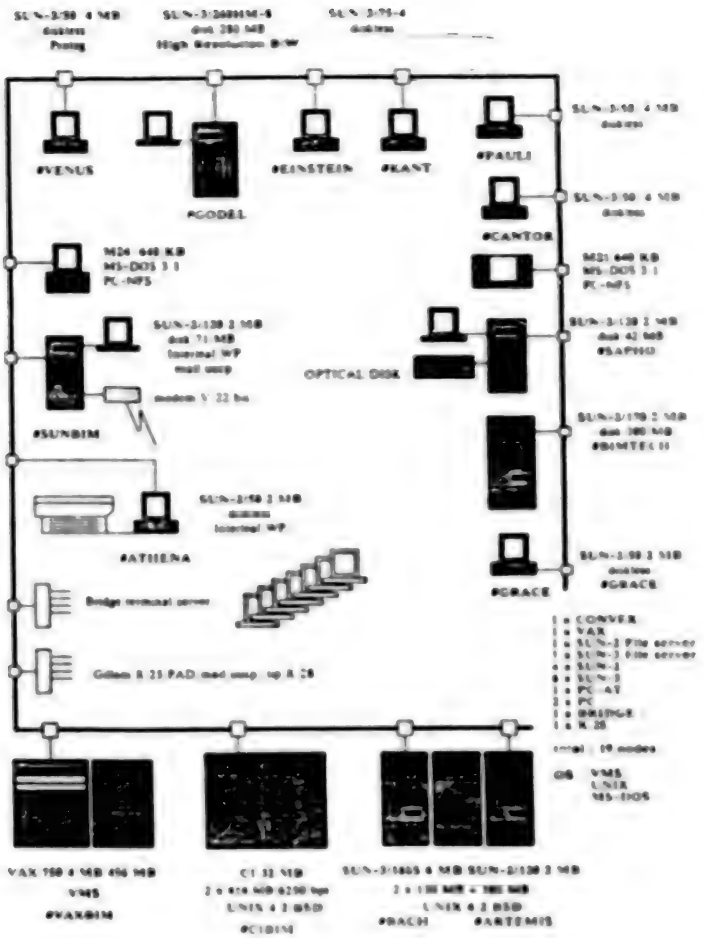
Other projects, such as ESPRIT project 107, called LOKI (Logic Oriented Approach to Knowledge Bases Interaction), can be seen in this framework. LOKI consists of two subprograms: a) development of an expert system for aircraft design, and b) development of a "natural language" interface. Nine participants are working on this project, including three companies: BIM, SCICON, and SCS [Scientific Computer Systems]. The latter two are associated with British Petroleum. The "natural language" interface is meant to simplify communication with databanks and expert systems. Although current developments are in English and German, BIM intends to begin developing a similar interface in Dutch and French late this year. All development is in BIM-Prolog. Further research is at present directed towards increasing vocabulary, incorporating more linguistic aspects, and finding a solution to problems of portability so that the interface can be more easily adapted to other applications.

Since the trend towards ever-faster chips is coming to an end, BIM is contemplating use of parallel processing, the so-called "concurrent Prolog," for further Prolog development. This project would make it possible for parallel processing to run on loosely connected machines standing in parallel.

Other ESPRIT Programs

BIM also participates in three other ESPRIT programs. The first, AMADEUS, is a feasibility study on the possibility of developing a universal method to compare projects developed by different methods. The final report will be finished by April of this year and will probably give rise to another application for an ESPRIT project. The other two programs, DAIDA and RUBRIC, both involve software engineering. DAIDA is software to help the user with the computer and computer languages, while RUBRIC helps a company use its own business principles to identify its requirements.

All R&D work is carried out in close cooperation with the [Flemish] Catholic University of Louvain, where five persons are on BIM's payroll; the [Walloon] Catholic University of Louvain (Louvain-La-Neuve); the Free University of Brussels; and the FNDP (Namur). Cooperation also extends to foreign universities, such as TUM (Munich, FRG), the University of Hamburg, and UMIST (Manchester, UK).



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CSO: 3698/A186

FRG: SIX MAJOR FIRMS PLAN JOINT RESEARCH AT ULM SCIENCE PARK

Duesseldorf HANDELSBLATT in German 11 May 87 p 16

[Article by "lt": "Six Firms Are Engaged in Joint EDP Research"]

[Text] Stuttgart, 9/10 May--The "science city of Ulm" being planned in close cooperation between the government and industry is taking shape. Thus, the land of Baden-Wuerttemberg will earmark a total capital expenditure of at least DM 100 million to expand the university and to establish an engineering school. Six large firms will be creating a joint research institute.

The above was announced in Stuttgart by Minister President Lothar Spaeth. This major science undertaking includes further a large research center for the Daimler Benz concern, as well as the creation of a new "science park" oriented to small-scale industry, in which small and medium-sized firms can tackle research tasks in close association with the scientific institutions.

On 7 May the Land government came to a contractual arrangement with six business enterprises to create a joint research institute at Ulm for applications-oriented knowledge processing; these firms are: Hewlett-Packard GmbH, IBM Deutschland GmbH, Mannesmann-Kienzle GmbH, Nixdorf Computer AG, Siemens AG, and Daimler-Benz AG.

Running Costs Are Covered by Contracts

The institute will be employing 40 scientists when it is finally completed.

According to Spaeth, 60 percent of the costs are to be borne by industry and 40 percent by the Land. In this connection, he said that the aim will be to cover about 70 percent of the running costs through research contracts from industry. An institute building costing DM 7.5 million is to be completed as early as in 1988. But the institute will be commencing its work even in the current year, on the premises of the Ulm Laser Institute. The final completion of this "unique in the FRG" institute is scheduled for 1989.

According to Spaeth, the field of activities of the institute includes the elaboration of scientific foundations for future computer generations as well as the appropriate software. He said that whereas at present the know-how stored worldwide in over 3000 data banks is not very accessible to small

businesses, by using the methods of this applications-oriented knowledge processing (artificial intelligence) it will be possible in the future for small and medium-sized businesses to also get access to this important information anywhere in the world.

"Third Supporting Leg" for the University

To the Land government, what the entire project is about is to realize new forms of cooperation between public institutions and private businesses, said Spaeth. He also said that with the planned shifting of the AEG research center from downtown Ulm to Upper Eselsberg and the locating of more research capacities of the Daimler-Benz concern likewise in the immediate vicinity of the university, an excellent basis exists for carrying out additional research activities "in close proximity" to the Ulm infrastructure.

According to Spaeth, in addition the Land of Baden-Wuerttemberg will expand the teaching and research capacity of the university and of the Ulm engineering technical college. He said that the aim is to create a "third supporting leg" for the university with the establishment of a school of engineering. In this connection, new departments are to be set up for high-frequency engineering, medical engineering, computer science, and power engineering, especially that of regenerative energies, as well as for the assessment of technology consequences.

Spaeth mentioned as additional important components of the future "science city" on Ulm's Eselsberg the intended building of research facilities for small-scale businesses after the model of American "science parks."

12114
CSO: 3698/466

BRIEFS

ESPRIT SOFTWARE TOOL LICENSED--According to terms of an agreement between the EEC and the GIE [economic interest group] Emeraude (Bull, Eurosoft, and Syseca) any project of the Esprit program can procure, free of charge, a license to use the Emeraude software engineering environment. Emeraude is the first industrial application of the PCTE [Portable Common Tools Environment] specification. For GIE this agreement is a decisive step toward the installation of the PCTE concept, which will allow 45 projects of the Esprit Software Technology sub-program to produce software engineering tools running under the same receiving structure. Available on Bull SPS7 workstations, Emeraude is presently being implemented on Sun Microsystems Sun 3, DEC Vaxstation, and IBM PC/AT and RT. Extension of Unix V, with which it is compatible, Emeraude is designed for networking machines. Its subject management system is distributed. The man-machine interface systematically uses windowing, images, and the mouse. [Text] [Paris ELECTRONIC ACTUALITES in French 6 Feb 87 p 4] 13112/8309

NIXDORF EXPERT SYSTEM--A new expert system ordains the union between telematics and artificial intelligence. Called Carl, this system provides a tool for helping in the creation of business firms and is accessible on Minitel. It was developed by Nixdorf in collaboration with the French firm NDV (National Digital Vacation). Made available to the general public through the host computer of the National Agency for Creating Business Firms, Carl can receive 128 simultaneous calls. Written in assembler, it comprises 210 rules. Its Level I inference engine will be the basis of all future developments of Nixdorf expert systems. Thus, for the month of February, the company announces Carl Fisc, a tool for helping in the preparation of income tax returns; and for next May, Carl Manager, an expert system for personnel evaluation; both on general public Minitel. Engaged in expert systems since a year ago, Nixdorf also designs applications for business firms. Carl can operate on a business network with the manufacturer's type 8860 host computers (network systems used as intelligent controllers oriented to telecommunications) or on 8890 systems (IBM-compatible mainframes). The Carl Enterprise family includes treasury, fiscal, and budget management programs. Installed with Nixdorf 8870 management systems, they use in this case data from the Comet package program of management. For about three years, Nixdorf and NDF have been partners in commercial activities, and in expert systems for a year. With 17 persons NDV had sales of Fr10 million in 1986 and forecasts Fr25 million this year. This company developed the Carl inference engine. Its activities are centered on expert systems and natural language interfaces. [Excerpts] [Paris ELECTRONIQUE ACTUALITES in French 6 Feb 87 p 6] 13112/8309

CSO: 3698/301

EXPERT SYSTEM FOR NONDESTRUCTIVE TESTING AT FRAMATOME OF FRANCE

Paris ELECTRONIQUE ACTUALITES in French 6 Feb 87 p 9

[Text] Chalon-sur-Saone--Artificial intelligence is the order of the day, just as an increased demand for quality is appearing. In this context, an expert system called Siracus has just been introduced by Framatome at St-Marcel en Saone-et-Loire, and could be the first of this type to be working in the field of nondestructive testing.

Siracus, which should begin operating in March 1987, provides assistance in characterizing the nature of weld defects by means of nondestructive ultrasonic testing.

Framatome and its affiliate Framentec developed the system, and it will be used to help the inspectors in recognizing the nature of a weld defect detected by a classical method (ultrasonic in this case).

Its development required 11 months and the following personnel: Three Framentec knowledge engineers (specialized in artificial intelligence), three Framatome experts, and two maintenance engineers also from Framatome. Siracus can be installed on an IBM-PC/AT-compatible personal computer. It has been developed by the Framatome nondestructive testing center together with Framentec, as we have stated.

Located on the Framatome industrial site at St-Marcel (Chalons-sur-Saone), this testing center is staffed with 40 persons, including 15 engineers and 20 technicians. It has competency and capabilities in the following testing fields: radiography, ultrasonic, electromagnetic-eddy currents, magnetic particle, liquid penetrant, and visual inspection. It engineers development and qualification of the procedures and provides laboratory, shop and field expertise. At the equipment level, it can also develop automatic testing systems, testing equipment and specific transducers, and software for acquisition and processing of the signals and analysis of the results. All of that for Framatome first of all, but also for outside industrial customers.

During the presentation of the Siracus system, M. Launay, chief of the nondestructive testing unit, indicated that the system had, of course, been developed for Framatome requirements but that it was suitable for satisfying customers on outside markets, including exports (instructions available in English). It will be available at a price equal to that of an ultrasonic testing apparatus.

It can be used by a Level 2 operator--according to COFREND [French Nondestructive Testing Committee] certification.

A Friendly Expert

Elaborated on the basis of the Framentec artificial intelligence software, called M1 generator, Siracus offers a twofold interest:

—In nondestructive ultrasonic testing it helps the operator to characterize the nature of the defects detected in the welds, since the system knew how to pick up and model the know-how of experts in this field; and

—It is an operator training instrument because its man-machine interface (communication and graphics) enables reproducing the habits and the conduct of the inspectors.

The operator performs the testing with a nondestructive ultrasonic device and a microcomputer. The equipment is easily transported and handled in an industrial environment.

The ultrasonic apparatus permits exposing the defect, then furnishes all of the information requested by Siracus. The latter communicates in natural language and guides the user by offering the choice of the search unit and the scanning direction (direction of propagation of the ultrasounds according to which the weld is explored). This communication is performed by means of screen pages so as to facilitate the task of the inspector who has one hand occupied by the search unit.

When the diagnostic elements are sufficient, the system classifies the defect as volumic or nonvolumic (this last type should be corrected) and announces the probable physical nature. One of the interesting features of Siracus is that it notes, draws, prints, and edits a complete expertise report once the operation is terminated: no longer any need to make sketches "on a table corner" and no more possibilities of transcription or omission errors.

Furthermore, it is possible to proceed backward and rerun the report, thus providing a training tool. The gain is not accomplished on the time spent but on the reliability of the results.

In its present state of development, this system is applicable for ferritic, homogeneous, butt-welded joints 50 to 250 mm thick. Work is under way to generalize its use for fillet welds and other configurations.

13112/8309
CSO: 3698/301

ROBOT SENSORS RESEARCHED AT POLYTECHNIC OF TURIN

Turin NOTIZIARIO TECNICO AMMA in Italian Jan 87 pp 22-25

[Article by Prof Guido Belforte and Eng Franco Bellosta of the Department of Mechanics, Polytechnic of Turin: "Object Discrimination by Means of Roughness sensors." The research was funded by the Ministry of Public Education]

[Text] Introduction

In handling objects with a robot, it is often necessary to transmit to the control system adequate information on the position and orientation of the object so as to enable the robot's hand to position itself and grasp the object. This necessary operation can be performed by means of different strategies based essentially on the following two methods:

--By equipping the robot with a system for recognizing the object and its position;

--Or by placing the object at a predetermined place, correctly oriented, and then bringing the robot there to grasp it.

The first of the two methods mentioned is generally quite sophisticated and expensive because it relies on visual systems. The second method can be simpler because the identification of some of the geometric characteristics of the object is sufficient to get the object oriented in a desired way.

In the case where the piece has two or more symmetric surfaces which are essentially the same geometrically (shape of contour, size of sides, etc.) but differ in degree of finish (for example, a parallelopiped piece having one finished surface and all others rough) the need arises to make the identification by detecting surface roughness.

This work describes the research done on a system able to distinguish different sides on the basis of their respective surface characteristics. The system consists of an air jet fluidic sensor inserted in a support structure, of a pressure transducer able to produce an analog electric signal, and of an electronic system for digitization and control.

The system analyzed is of a new type and can be utilized in very general ways. The sensor can be installed in a fixed position, with the object of which the sides are to be identified brought toward it, or it can be mounted on a mechanical hand giving it tactile sensor capabilities.

Description of the System

A general diagram of the system is shown in Figure 1. Visible is the sensor element represented by an air jet induction sensor facing the surface to be sensed, and the pressure transducer which produces an analog voltage signal processed by the controls electronics.

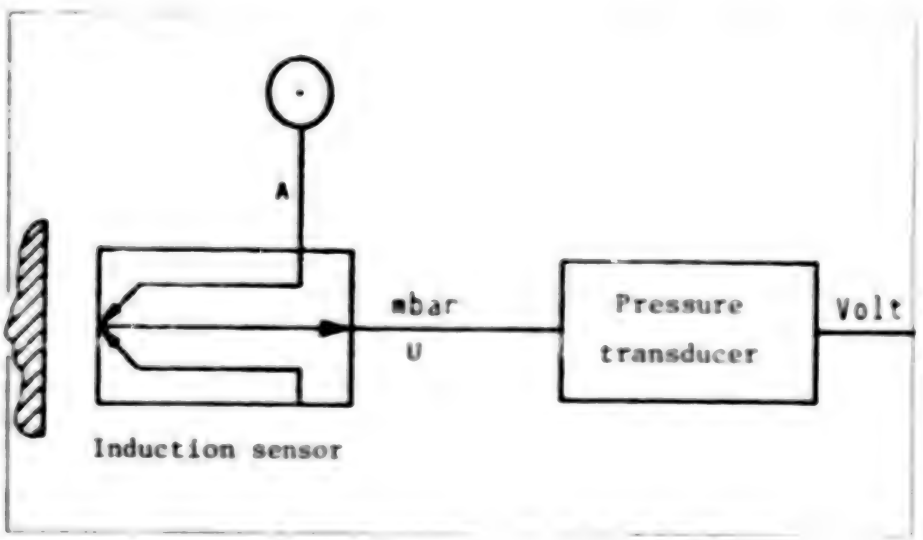

Figure 1. Functional Scheme of the System

The sensor employed is of the parallel jet type. Figure 2 shows how it is positioned during its use. Sensor (S) is placed in a hole in plane (2) on which is placed the surface (1) to be recognized. The sensor is then kept in position and registered by means of a bracket (3), onto which it is held by a system of threaded surfaces.

The nozzle head, fed through the conduit (a), has the shape of a circular crown, as indicated by (4) in Figure 2. The outgoing jet is initially cylindrical and hollow inside. As it moves away from the sensor, it generates drag phenomena sensed by the exit conduit (U) connected to the central chamber (5).

If there is no obstacle in front of the sensor, the jet formed on the outside generates a pressure depression in the exit conduit. As a flat object is brought nearer to the exit surface of the sensor, the jet outflow is disturbed. This reduces the drag effects and the measured pressure depression is less, to the point of reaching zero at a certain distance from the object. As the object is brought nearer, an overpressure is generated due to the resistance met by the fluid as it flows out.

Figure 2. Sectional View of the Device With the Original Sensor

It should be noted that the disturbing effect on the outflow jet varies as a function of the distance of the surface and its roughness.

The strength of the signal generated by the sensor, therefore, depends on two external parameters: the distance, and the roughness of the surface to be sensed. A third parameter controlling the generated signal is the pressure level used in feeding the sensor. In general, the pressure for feeding a fluidic induction sensor has a value between 50 and 500 mbar.

The sensor is also normally protected by a cylindric cover (6) which, in this instance, is inserted in the hole. To prevent overpressure effects inside the cylindric cover, discharge holes (7) connect the area (8) between the cylinder and the emitting ring with the ambient atmosphere.

Figure 2 shows that the average distance between the outflow area of the sensor and the sensed surface is relatively small.

The reason for this choice is due to the necessity of having to differentiate different shapes of surfaces which present different resistance effects on the outflow of the sensor. Since the sensor's operation is based essentially on resistance variations, it has to operate at distances small enough to still sense resistance effects.

As shown in Figure 1, the pressure signal from the sensor is sent to a pressure transducer which produces an electrical voltage signal proportional

to the input pressure level. This electrical signal can be easily measured and analyzed.

The sensor used is a Festo microsensor of the RML-5 type, with an emitting circular crown (4) 5 mm in diameter, and a protecting cylindrical cover 10 mm in diameter.

The pressure transducer was chosen so as to be able to detect very low pressure signals. We chose the 144 PC01D7 type produced by Honeywell. This transducer outputs 5 volts when the input is a pressure equal to ambient pressure. An overpressure input causes an increase in output voltage at a rate of 0.122 volts/mb. Similarly, a decrease in pressure causes a voltage drop of the same rate relative to 5 volts.

Experimental Tests

Experimental tests have been performed to determine a relationship between output signal and surface irregularity disturbing the jet outflow. As was indicated, the system is structured such that an overpressure is generated when the surface being tested is laid upon it.

The magnitude of this overpressure is a function of how strongly the piece is held, which in turn depends on the irregularity of the piece laid on the sensor.

To establish the relationship between the voltage output from the transducer (or the overpressure of the output signal from the sensor) and the irregularity of the object, output signal values were recorded for sample objects with known surface irregularities. These data were used to plot curves expressing the operating characteristics of the system.

To define the relationship between output signal and the roughness of the objects, test blocks have been prepared with grooves having a cross-section shaped like an equilateral triangle. The parameter characterizing each block is the pitch p, or the distance between two adjacent grooves. In fact, by varying the pitch p, the depth h is also varied according to the relationship $h = (\sqrt{3}/2) \cdot p$. Eight blocks have been prepared with the following grooves pitch (in millimeters): 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4. The greatest resistance to air outflow is caused by the block with 0.5 mm pitch grooves.

The surface of the blocks on which the grooves were hatched has a trapezoidal shape (Figure 3); this was done to evaluate effects caused by the length of the conduits through which the air is discharged.

Various experimental tests were performed. The results reported here are for four groups of tests with different sensor configurations and constant air feed pressure. For each test we recorded by means of a voltmeter the output voltage V_u associated with each block. Each of the four tests were performed by feeding the sensor with air at a pressure of 100 mbar.

Figure 3. Sample Block Used for Analyzing the System

The first test was performed with the sensor in its original configuration (Figure 4a). Note that in this case the section from which the fluid exits is slightly lower than the support surface (p) for the blocks; this is due to the sensor protection ring which is aligned with the support surface. Table I shows the results of this test.

A more in-depth analysis of the phenomenon suggested a few modifications.

First of all, we eliminated air losses through the holes in the protection ring; this increased the sensitivity of the sensor to variations of resistance caused by the blocks (Figure 4b). To eliminate the air losses, the toroid shaped chamber surrounding the emitting sensor element (chamber 8 of Figure 2) was filled with mastic. Table II shows the results obtained.

A further modification was to make the "p" surface on which the blocks are laid coincide with the plane containing the mouth of the emitting sensor (Figure 4c). For the purpose of this test, the sensor protecting ring was refinished. Table III shows the results of the test.

The fourth test was performed while keeping the sensor in the same position as in the previous test, but changing the position of the blocks which are raised 0.5 mm above the support surface. This was achieved by gluing two calibrated shims on the support surface (see Figure 4d). In this case, the disturbing action caused by the surface of the block is attenuated, as shown by values in Table IV.

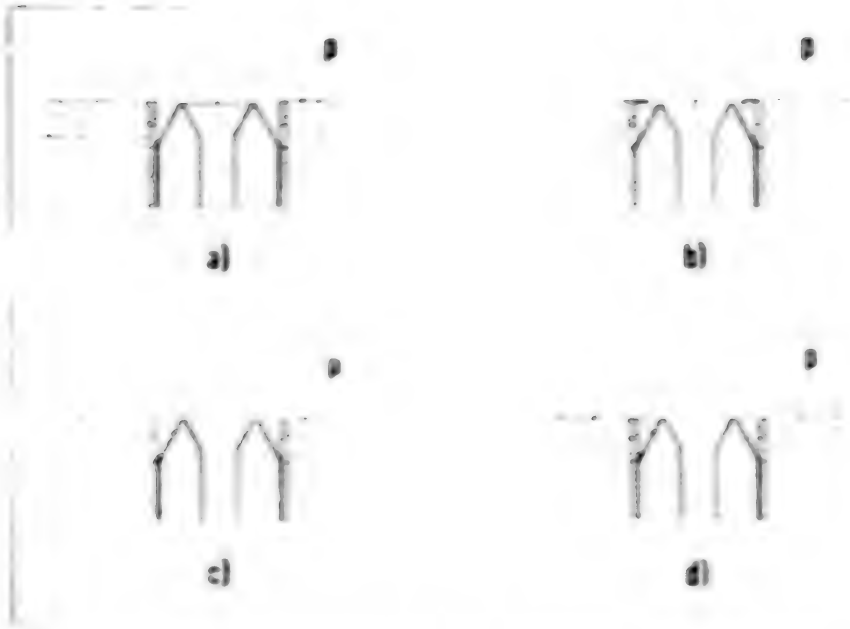

Figure 4. Different Configurations of the Sensor: a) original sensor; b) sensor with the area outside of the emitter blocked; c) sensor placed at level of support surface; d) sensor with shims for raising the object being sensed

Table I. Experimental Results Obtained With Original Sensor Having the Outflow Nozzle Lower Than the Surface Supporting the Objects

Number of grooves per cm (1/cm)	Minimum pressure (mbar)	Maximum pressure (mbar)	Average pressure (mbar)
2.5	1.48	2.62	2.05
2.86	1.23	3.28	2.25
3.33	1.23	4.26	2.75
4	2.62	4.67	3.65
5	3.36	5.49	4.43
6.67	4.92	6.64	5.78
10	6.89	8.44	7.67
20	10.74	10.98	10.86

Table II. Experimental Results With Original Sensor and Blocked External Chamber

Number of grooves per cm (1/cm)	Minimum pressure (mbar)	Maximum pressure (mbar)	Average pressure (mbar)
2.5	1.15	2.05	1.6
2.86	1.23	2.62	1.93
3.33	1.31	3.11	2.21
4	2.38	3.93	3.16
5	2.95	5	3.98
6.67	5.08	6.89	5.99
10	10.33	11.23	10.78
20	29.02	29.18	29.1

Table III. Experimental Results With Refinished Protecting Ring

Number of grooves per cm (1/cm)	Minimum pressure (mbar)	Maximum pressure (mbar)	Average pressure (mbar)
2.5	0.74	2.13	1.44
2.86	0.90	2.5[illegible]	1.72
3.33	1.07	3.11	2.09
4	2.62	3.69	3.16
5	3.28	5.08	4.18
6.67	5.74	7.38	6.56
10	12.13	13.93	13.03
20	34.92	36.48	35.70

Table IV. Experimental Results With Raised Blocks

Number of grooves per cm (1/cm)	Minimum pressure (mbar)	Maximum pressure (mbar)	Average pressure (mbar)
2.5	0.82	2.38	1.6
2.86	0.57	2.7	1.64
3.33	0.66	3.11	1.89
4	2.13	3.28	2.70
5	1.97	3.77	2.87
6.67	2.62	3.85	3.24
10	3.61	4.18	3.90
20	3.69	4.34	4.02

All the tests performed show no appreciable difference caused by the width variation of the block placed next to the mouth of the sensor.

The overall analysis of the data shows that the third test gave the greatest sensitivity of the system to the resistance variation produced by the blocks.

Figure 5 shows the curves which express the relationship between the average values of the pressure P_u measured by the sensor for each block and the shape of the blocks for the four tests. In the graph, the shape of the blocks has been identified in terms of number of grooves per centimeter.

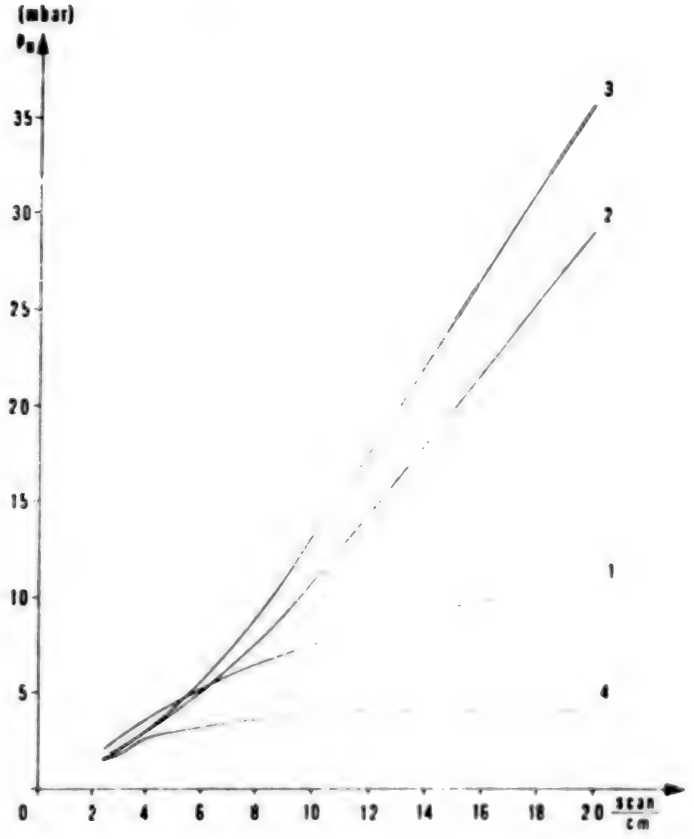

Figure 5. Exit Pressure for Objects With Different Roughness and for Different Sensor Configurations

Figure 6 presents the two curves which show the maximum and minimum values recorded in the third test, as a function of the grooves per centimeter on the blocks. From this graph one can establish the uncertainty of identifying the blocks by means of the measured pressure. For example, a hypothetical piece which, when placed on the system produces a pressure P_u of 20 mb can have a number of grooves per centimeter varying from 12.6 to 13.5.

Conclusions

The results presented show that it is possible to construct a system which, when appropriately instructed on the roughness characteristics of a series of objects, is able to identify them.

This system, which is extremely simple in construction and therefore of limited cost, can be easily integrated in an automated system by using an appropriate interface element. An application of this system for the identification of surfaces of semiconductor wafers has already been realized.

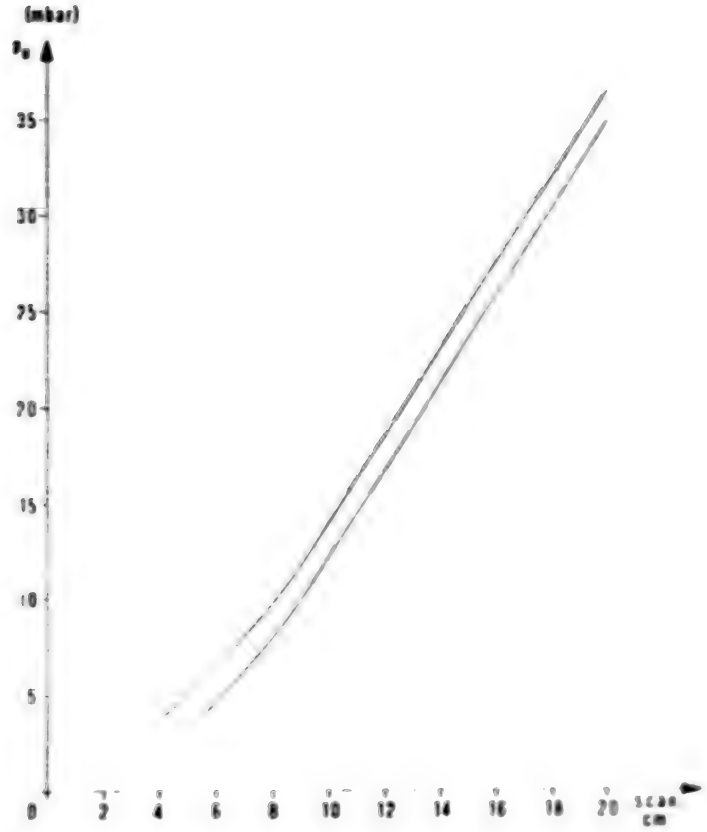

Figure 6. Maximum and Minimum Pressure Values for Sensor Placed at Level of Test Support Surface

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13120/6091
CSO: 3698/476

BRIEFS

FRENCH ROVING ROBOT—The French atomic energy commission (CEA = Commissariat a l'Energie Atomique) and ELF AQUITAINE are cooperating in development of a prototype surveillance robot for use in the ELF oil refinery in Grandpuits, France. This new device, to be called the "roving robot", will be built over a period of 2 years. It will be designed to move about independently through the plant and to "see, hear and feel" plant occurrences through a set of built-in sensors. By acting as a mobile data receiver/transmitter unit, it will supplement the action of existing stationary sensing devices for the purpose of detecting fires, gas leaks and defects in rotating machinery. [Text] [Paris FTS—FRENCH TECHNOLOGY SURVEY in English Mar 87 p 6]

FRENCH FLEXIBLE SYSTEM—The firm AUTOMATISME TECHNIQUES AVANCEES has developed a flexible system for manufacture of wires and cables with varying characteristics. Through use of fast-acting automatic circuitry, the new robot enables transfer from one wire to the next in no more than a few tenths of a second and permits batch sequencing at intervals of only several seconds. Coupled with the resulting gain in productivity, this means that one such robot can handle the operations normally performed by 10 human operators. Because it can produce cables with differing lengths, identification markings and terminations in consecutive batches, the device also eliminates the need for intermediate storage and conventional handling equipment and reduces in-process inventories. Its manufacturing range extends to products such as festooning cables, heat shrinkable sheathing and sophisticated marking systems, which did not heretofore lend themselves to automation. The robot measures 1.8 x1.8 m and weighs 500 kg; it is equipped with 20 different modules and is specifically geared to production of cables and wires in electrical enclosures, large computers and the automotive industry. [Text] [Paris FTS—FRENCH TECHNOLOGY SURVEY in English Mar 87 pp 5-6]

CSO: 3698/A201-E

ESPRIT PROGRAM RESULTS, FUTURE, STRATEGY CONSIDERED

Paris LA JAUNE ET LA ROUGE in French Oct 86 pp 29-34

[Article by Jean-Marie Cadiou, 60, a Polytechnique graduate and currently director of ESPRIT/Information Technologies for the EEC: "ESPRIT: The First Results"]

[Text] Two and one-half years after its inception the ESPRIT program (European Strategic Program for R&D in Information Technologies) has already begun to produce tangible results. This article will examine the motivation and objectives of the program, as well as its methods. It will then review the principal results already achieved and give some indication of its future prospects.

Why ESPRIT?

ESPRIT is a European industrial cooperative program for R&D in information technologies [IT]. Three main questions about this topic arise:
- Why choose the IT sector?
- Why European cooperation?
- Why in R&D?

Why the Information Technology Sector?

This sector, which comprises a whole series of strictly separated activities (such as data communications, office systems, and computer-integrated manufacturing), is generally considered one of the key sectors determining overall economic competitiveness. Indeed, it accounts for nearly 60 percent of all economic activity (production and services combined), and thus employment. The IT sector alone represents about 8 percent of the GNP and has a high annual growth rate of 15 to 20 percent. This rate will doubtless continue through the 1980's, making IT the single most important sector of activity in absolute terms.

However, Europe's presence in this sector is not what it should be, and the market share of European manufacturers has dwindled steadily. Thus, from 1978 to 1985, their share of total world production in microelectronics dropped from about one-third to roughly one-fourth. Another indicator is Europe's trade balance in IT products, which is unfavorable and shows signs of worsening.

Given the strategic importance of this sector (without even considering its military aspects), this situation is not [line missing from original] this is possible under certain conditions.

Why European Cooperation?

Under the circumstances, the European countries have obviously taken measures in their separate interests, some of them for some time now; as a result, companies have taken a national focus as their first line of priority. In fact, European IT companies make about 50 percent of their sales on their domestic markets.

The major disadvantage of this approach, whereby each country supports its "national champion," has been to blunt the companies' ability to compete, while confining them to markets that are too narrow to ensure healthy growth. Indeed, the investments required by IT are so high that no national market is large enough to make them pay off economically.

This is possible on a European level. The 12 countries of the EEC are potentially the largest world market and the [line missing from original] establishment in the Community will lead to major progress in its integration by 1992.

Why Cooperation in R&D?

R&D obviously plays a major role in high technology. To be sure, R&D alone is not enough--in fact, elements affecting the market are just as important, if not more so--but in general, one must have access to the most advanced technologies in order to be competitive.

Given this fact, and given the vital importance of R&D to a high tech business, it might seem paradoxical that industrial cooperation between competitors has actually begun.

Nonetheless, it is on the rise: This holds true in Japan--with its VLSI, fifth generation, supercomputer, and Sigma programs--in the United States (MCC (Footnote 1) (Microelectronics & Computer Technology Corporation) and SRC (Footnote 2) (Semiconductor Research Corporation), to cite only two examples out of some 40 such ventures begun over the last 2 years), and in Europe, notably with ESPRIT but also through other initiatives such as EUREKA and ECRC (Footnote 3) (European Common Research Center (laboratory for joint research by Bull, ICL, and Siemens)).

There are three basic explanations for this: the ever increasing costs of R&D investments (which must pay off within a constantly shorter time frame due to the faster rate at which new products appear), the uncertainty of technological evolution, which makes it necessary to simultaneously explore various possible solutions, and finally, a shortage of highly skilled research engineers. Industrial cooperation is a way to limit costs and share risks and engineers. It is easiest to establish and especially fruitful during the precompetitive stage.

Another important factor to consider is the distortion of competition caused by the Japanese and American Governments' massive investment in the R&D of high tech companies. In the United States, in particular, public funding for R&D in IT has nearly doubled in 4 years, with an emphasis on military programs. It is noteworthy that 40 percent of SDI spending will be for IT R&D.

ESPRIT: Goals and Methods

Launched in February 1984, the ESPRIT program has three goals:
- to promote research-oriented European industrial cooperation in areas in which there are real possibilities for such work to take hold;
- to provide European industry with the basic technologies it will need to meet competitive requirements in the 1990's;
- to prepare the development of international standards from a strong and united European position.

This is a 10-year program, conceived and carried out by IT companies; it is funded half by the EEC and half by the participants. The first phase (1984-1988) represents a total effort of 1,500 million ECU's (Footnote 4) (About Fr 9.5 billion (1 ECU = Fr 6.3183 as of 1 September 1986)).

The program is administered by the EEC Commission, aided by the Industrial and Scientific Council, the EAB (Footnote 5) (EAB: ESPRIT Advisory Board, composed of 16 members chosen by the commission for their expertise in large- and medium-sized companies and in the scientific world), and the EMC (Footnote 6) (EMC: ESPRIT Management Committee, which coordinates with the national administrations of the member states), a committee composed of representatives of the member states.

ESPRIT is put into action through projects selected following public calls for proposals and is based on a work plan updated yearly. So far there have been two such calls, in 1984 and 1985, and a limited complementary call in 1986. From the more than 1,000 proposals received, some 200 projects have been selected and begun. Participants include 450 companies, universities, and research centers. After a rapid build-up, there are now some 2,900 research engineers and researchers at work throughout the EEC countries. The first phase is now in full operation, running about 2 years ahead of its original schedule.

The program focuses on five areas: microelectronics, software technology, information processsing, office systems, and computer-integrated manufacturing.

All the projects involve cross-border industrial cooperation, i.e., each project involves at least two companies from different member states.

In addition to its strictly transnational and European nature, another basic characteristic of the program lies in the way the work plan, which provides orientation for the program, is prepared through a process of consultation and dialogue involving some 300 experts from all IT sectors. The work plan

sets goals and defines a framework for joint work. Having taken part in the process from the start, the participants are all the more ready to take action. The Round Table of Europe's 12 largest IT companies (Footnote 7) (AEG, Bull, CGE, GEC, ICL, Nixdorf, Olivetti, Philips, Plessey, Siemens, STET, and Thomson) takes an active part in this work. Through this "bottom-up" approach, the commission provides a neutral framework which facilitates consensus and the beginnings of cooperation (the main subjects and themes of the work plan are mentioned in the box below).

To facilitate the preparation of proposals, before each call for bids the commission organizes a "bidder's day," at which interested parties can meet and sift through themes of common interest. At the largest call for proposals, in 1985, there were more than 800 participants.

To encourage exchange, the commission also organizes a yearly conference each September which brings together project participants; during these conferences the most significant results are presented.

Proposal selection is a difficult job, because the program's success has generated five times as many proposals as it can fund; it is handled in the most professional and open way possible: by conferences of independent experts organized around each theme. Each proposal is anonymously evaluated by the experts and then subjected to a group debate which results in a final report.

What Is the Current Status of the Program?

Obviously, only 2 and 1/2 years after the inception of a 10-year program which is implemented through projects lasting 4 to 5 years, it is impossible to draw a complete picture. Nonetheless, we can already make a certain number of observations, and partial results have begun to appear.

First of all, interest has been considerable, as witnessed by the very high number of proposals received and by the fact that all allotments for the first 5 years have already been assigned.

Moreover, project participants demonstrate a very positive attitude, as shown by the independent survey conducted in mid-1985 by three individuals (Pannenborg, Danzin, and Warnecke), whose task it was to make a preliminary evaluation of the program. The results of this survey, which have been made public, show that a very large majority of the participants think ESPRIT will attain its goals. In particular, perhaps the main point at this stage, they fully confirm (97 percent positive responses) the viability of European industrial cooperation in ESPRIT-like programs, a hypothesis that was far from evident at first.

Overall, the mix within the teams is quite good. Each project includes an average of 3.5 company participants, and universities and research centers participate in 75 percent of the projects. Moreover, companies of all sizes participate, not only the largest companies but also medium-sized and even very small firms: Of the 240 firms participating in ESPRIT, 130 have less than 500 employees, and half of these less than 50.

We should also mention the excellent French participation in the program: Seven out of ten projects include a French participant, and within each project, French companies generally contribute about one-third. The proportionately comparable results obtained for other countries indicate the extent of the mixing.

Without describing the projects in detail in this article, it may be useful to give a few examples which illustrate the richness and diversity of the cooperation in progress. I have selected four such examples.

1) Interconnection Technologies for VLSI

This project is an example of cooperation between four large companies of comparable size: Plessey, GEC (both UK), Thomson (France), and AEG (FRG). The project is a typical example of "risk sharing" between companies because they work in parallel on alternative approaches, having agreed on a common technology and common test masks as well as identical test equipment. Thus, for dielectrics, Thomson is working on oxides, GEC on nitrides, and AEG and Plessey on polyimides. A patent has been filed for the smoothing process (polyimides), one of the major problems in interconnection technologies. Of course, the rules of the game state that the results are shared and that the four companies will all have access to the best process developed. This project has already produced concrete results. Plessey thus recently announced a 200,000-gate signal processing chip with a 16-bit dedicated microprocessor, using the three-level metallization technology developed by the project. The first specimens will be available late this year (1986).

2) Algorithms and Implantation Technologies for VLSI Signal Processing

This project is conducted by IMEC, a small high technology company originated at the University of Louvain (Belgium), with participation by several other firms, notably Philips and Siemens, which bring their industrial experience to bear in evaluating the tools developed. This project has developed CAD tools for signal processing integrated circuits which allow greater automation than any other circuit currently in existence. Philips is already using this tool to design digital filters for its video recorders.

3) Message Switching Architectures

This is a knowledge engineering project conducted by DELPHI, a very small company working at the forefront of advanced technologies, established by a group of MIT-trained Italian research workers and specializing in AI. The project has already yielded one product, a design tool for expert systems known as OMEGA, which is already in use by several other ESPRIT projects.

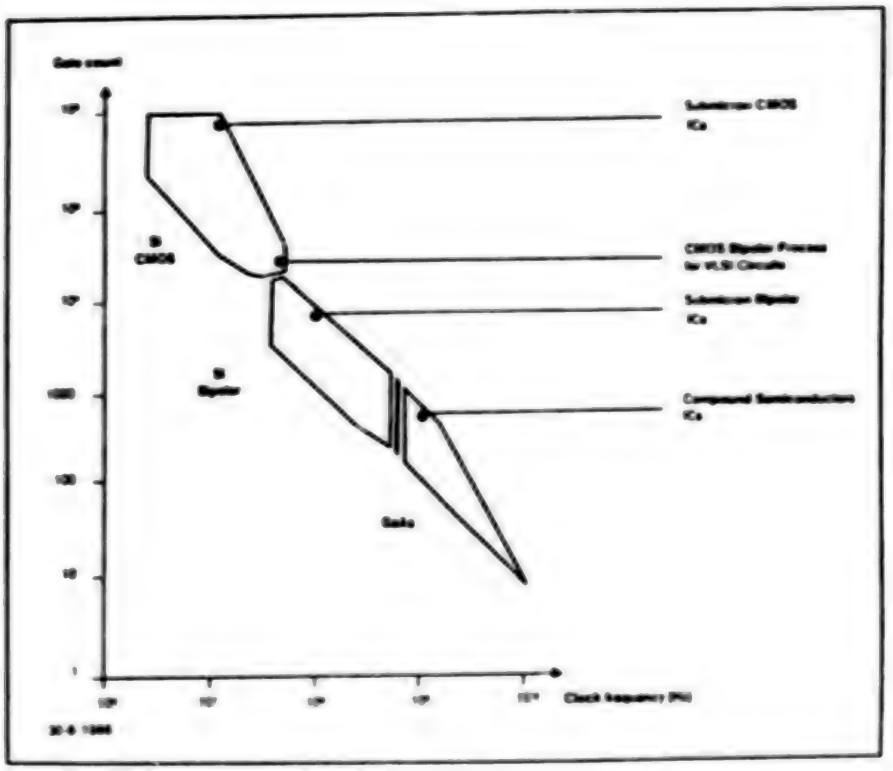
4) Robot Systems Integration

This project is an example of cooperation among robot manufacturers (FIAR of Italy and KUKA of the FRG), a user (Renault), and universities and specialized research centers. The participants are working on integrating robots in CAM processes and have published a set of rules for interface specification which are already used by other program participants.

Of course, the program has yielded other results, some of which are mentioned below.

In microelectronics, in the area of integrated circuits, four projects are on the forefront of technological development, as the graph (Figure 1) shows.

Figure 1. Integrated Circuit Technology



The Y-axis is gate count and the X-axis is clock frequency. The application areas represented correspond to three technologies: CMOS (silicon), which permits the greatest integration, bipolar (silicon), for the fastest silicon circuits, and gallium arsenide, for even faster speeds than with silicon. Under identical performance conditions, gallium arsenide circuits use 5 to 10 times less energy than silicon circuits, which reduces the problems of heat dissipation.

The four projects, represented by the four black points in Figure 1, are on schedule. Two examples demonstrate their competitiveness:

- The project for submicron bipolar technology (Siemens-Philips) has just achieved a 10,000-gate circuit with 200-picosecond (10^{-12} sec) access time in 1-micron technology, which equals the best world performances. Siemens has announced a DM200-million investment for the production line, a pilot of which should be operational in the first quarter of 1987.

- The compound semiconductors project has created a 1-Kb memory in gallium arsenide with 4 nanoseconds (10^{-9} sec) in access time and 80 mW in consumption. This technology is extremely interesting for signal processing and supercomputers due to its low power consumption. Philips, one of the project participants, has also signed a research contract with Cray, one of the world leaders in supercomputers, for the circuits of its next generation of machines (Cray III).

In software technology, the program centers around a central project, the PCTE (Portable Common Tool Environment). The project's goal is to create a common environment for the development of software tools which can be ported from one machine to another. Six of the largest European computer manufacturers are working on this project: Bull, ICL, Siemens, Nixdorf, Olivetti, and GEC. A first version of PCTE was tested in December 1985. Less than a year later (September 1986), GIE [Economic Interest Group]-Emeraude began marketing the second version, an example of rapid industrial application of ESPRIT's results and of good coordination between the European and national programs, here that of France. Beyond these concrete achievements, this project has already had an impact on the product development strategies of these companies: Thus, a large industrial group, X-OPEN (Footnote 8) (This group includes Bull, ICL, Nixdorf, Olivetti, Philips, and Siemens of Europe, and DEC and Sperry of the United States), has already established the objective of adopting a common single interface for all its members' UNIX operating systems.

In information processing, major efforts have focused on knowledge engineering in particular. Europe is a leader in this area, notably with the PROLOG language invented by A. Colmerauer and his team in Marseilles and since used by the Japanese (fifth-generation computer project) and in certain American AI projects. One of the ESPRIT projects, LOKI (Footnote 9) (Logic Oriented approach to Knowledge and databases supporting natural user Interaction, a project including the Belgian Institute of Management (Belgium), the Fraunhofer Institute (FRG), Scicon (UK), and several other universities and research institutes), has among other things developed the best existing PROLOG compiler, best in that it produces an object code with a faster execution time than that produced by any other PROLOG compiler in the world (September 1986).

PROLOG is being further developed in another ESPRIT project, directed by A. Colmeraurer, to combine digital and non-digital processing. This is being tested in the building of an expert system for failure diagnostics in automobile engines. The system was developed by the other project participants, together with Daimler-Benz and Bosch of the FRG.

Future Prospects

Encouraged by its positive results, the program's industrial participants have declared their intention to considerably strengthen their cooperation under the program's second phase. Moreover, the intensification of international competition necessitates a substantially increased effort, and these two factors have led the commission to prepare the launch of the second phase in 1987, 2 years ahead of schedule. The scope of this second phase should be about three times that of the first.

Among the new features of this second phase is the inclusion of a limited number of very large projects, called technology integration projects, which will be the object of strategic cooperation on matters requiring large-scale industrial efforts. These projects are outlined in the Figures 2 and 3.

Figure 2. ESPRIT Phase II Technology Integration Projects

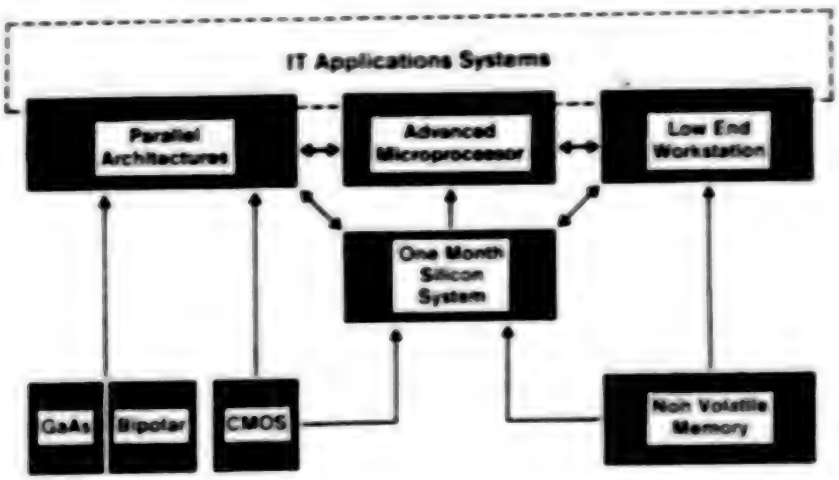
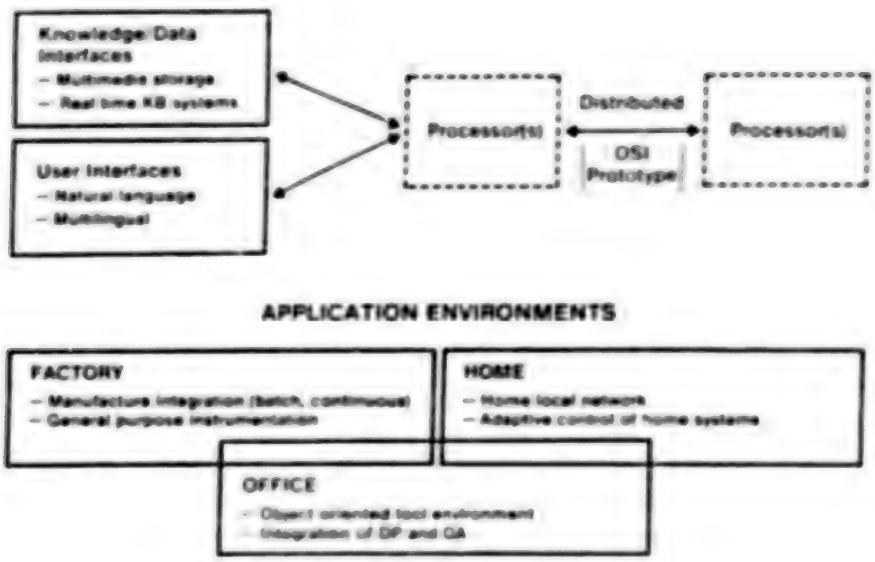


Figure 3. ESPRIT Phase II Application Technology Integration Projects



Conclusion

The ESPRIT program has so far met--and probably exceeded--expectations. Concrete results have begun to appear, some of which we have listed. The indirect effect on corporate strategy contributes substantially to building Europe, as does the European openness for engineers and research workers who are involved in the projects and can thus establish contacts with their counterparts from other European countries. At a time when "Europessimism" is fashionable, especially in high technology, this example deserves notice. Nothing has yet been lost! On the other hand, nothing is yet won either, and it would be dangerous to underestimate the extreme difficulty of the undertaking confronting Europe.

[Box, p 31]

ESPRIT Work Plan

Theme 1: Microelectronics

- Submicron bipolar processes
- Computer-aided design
- Compound semiconductor integrated circuits
- Optoelectronics
- Flat-screen technologies
- General research topics and related areas

Theme 2: Software Technology

1. Theories, methods, tools
   - System-oriented approaches: formal development methods; hardware-software synergy; software security
   - Improvement of current approaches: reuse; formal specification; transformations
   - Advanced approaches: formal description methods and verification of distributed, real-time, and integrated concurrent systems; systematic study of software development processes; application of AI techniques
   - Quality, reliability, conformity
2. Administrative and manufacturing aspects
   - Software production and maintenance
   - Project and product management; trade protection
3. Common tool environment
4. Evaluation and demonstration projects

Theme 3: Information Processing

1. Knowledge engineering
   - Knowledge processing
   - Natural dialogue and languages
   - Development and application of knowledge systems
2. Advanced signal processing and man/machine interfaces
   - Image processing: two- and three-dimensional, depth, movement, synthesis

- Speech recognition and comprehension
- Multiplier signal processing

3. Information and knowledge storage
   - Construction of databases and knowledge bases
   - Access systems
   - New physical supports
4. Computer architectures
   - New communication mechanisms
   - Non-Von Neumann machine architectures
   - Architectures for integrating symbolic and digital processing
   - Architecture for high-level parallel processing

Theme 4: Office Systems

1. Science of office systems and human factors
2. Advanced work stations
   - Workstation design and security
   - Vision, paper, speech, languages, and automated office procedures
3. Communication systems
   - Systems architecture, security, agreements
   - Technology of broadband optical local area networks and communication technologies
   - Distributed systems
   - Services: multimode electronic mail, ISDN videotext, teleconferencing, etc.
4. Systems for storage and retrieval of multimedia information
5. Integrated office systems: architectures; test benches and facilities.

Theme 5: Computer-Aided Integrated Production

1. Integrated systems architectures
2. Computer-aided design (CAD) and engineering (CAE)
   - Use of AI technologies
   - Graphics systems; control and monitoring systems
3. Computer-aided manufacturing (CAM)
4. Flexible production systems
   - Specification, architecture, implementation
   - Automated assembly
   - Installation availability and quality optimization.
5. Subsystems and components
   - Sensor systems for real-time capturing and interpreting of sensor data
   - Microelectronic systems for automatic control of machines and systems
6. Application and development centers for computer-integrated manufacturing
   - General related topics

25060
CSO: 3698/A173

NETHERLANDS IC MANUFACTURERS UNITING R&D ACTIVITIES

Amsterdam COMPUTABLE in Dutch 27 Feb 87 pp 1-2

[Article: "Nine Companies in IC Research Institute"]

[Text] Amsterdam—Nine Netherlands IC manufacturers are planning to set up a joint research institute following the example of the West German Institute for Microelectronics among others. It will take some 12 months to set up and require a 30- to 100-million guilder investment depending on the research program involved.

The initiators believe that most of the Netherlands IC manufacturers are too small to bear the costs of intensive research themselves. Thus they are trying to join forces to share the costs. The nine companies are ASIC, Rood Test House, Silicon Compilers, Sierra Semiconductors, Sagantec, ICD, Align Rite, Pijnenburg Software Developments, and Catena Micro Electronics. The project is coordinated by Industriele Consulenten Nederland.

The research institute will be called the Netherlands Institute for the Research of Silicon Integrated Circuits (NIRSIC) and requires a substantial investment. In the ECONOMISCH DAGBLAD newspaper Dr Eng P. Langendam of ASIC in Nijmegen mentioned an amount of from 30 to 100 million guilders. As an annual budget of some 10 million guilders will also be required to keep the institute operational, the Ministry of Economic Affairs was drawn into the discussions at the earliest possible stage. According to Langendam, the ministry seems to be "moderately interested" in the project. But whether the ministry will participate and, if so, to what extent is not yet known.

The institute's tasks will not be limited to application-oriented research and product development. Basic research may also be included (which would undoubtedly increase investment towards the aforementioned 100 million guilders). Meanwhile, advisory work, training, and similar ideas are also being considered. Participation in the project will not be limited to the nine initiators, but the institute will not be open to large companies. The initiators fear that because of their size they would have too much impact on the institute's research activities. They hope, however, that the university community will participate.

The idea to share IC research costs is not new. Similar initiatives have already been taken in such countries as Belgium, France, and the FRG.

25039/8309
CSO: 3698/A158

ES2 TO SAMPLE FIRST INTEGRATED CIRCUITS IN SEPTEMBER

Paris ELECTRONIQUE ACTUALITES in French 15 May 87 p 16

[Article by D. Girault]

[Text] ES2 is well on the way to meet the challenge it set for itself at its inception: To make available to all designers a tool that will enable them to obtain custom integrated circuits for their specific needs within approximately 3 weeks.

ES2 has not cut corners in the process of meeting this challenge: Its Rousset factory cost $60 million, the same as the Aeble 150 electron beam direct writing system manufactured by Perkin-Elmer. The recent acquisition of Lattice Logic is in keeping with the policy of continuity in design/manufacture promoted by the European start-ups which have an equal stake in both silicon compilation and direct writing on photosensitive resin.

The best part, according to Mr Demange, director of the southern European region and vice president of ES2, is that schedules are being met. Starting in September, the first test samples will come out of the Rousset plant and marketing of the products should begin at the end of the year.

In 1988, all circuits will be processed by direct writing and the 15 day period for obtaining these will be respected, compared to the 6 to 8 weeks required when "ordinary" photolithography technology is used. This will be made possible by the Aeble 150, one of which is scheduled for installation at the Rousset location by next June; this is the same system that ES2 has tested at the office it rented from the Excel company at its San Jose, California plant, near the Perkin-Elmer corporation. In addition to rapid manufacture of circuits provided by the Aeble system--the machine can currently process five layers per hour (up to seven layers per hour 5 years from now?)--another advantage of direct writing is that it eliminates the cost of masks--estimated to range from $25,000 and $30,000-- since, on average, one circuit requires from 10 to 12 masks worth $2,500 apiece. ES2 provides prototypes for $10,000 while with conventional masking techniques, the cost of masks run to $25,000 plus $8,000 to $12,000 for producing the prototypes. On the other hand, ES2 is restricted to volumes of less than 50,000 units because the unit price of circuits is substantially higher when using direct writing technology is used. For quantities ranging from 10,000 to 50,000 units, photolithography is less

expensive.... It should be added that mask manufacturers are dramatically reducing their prices and production times. This leads to legitimate questions regarding the possibility of a battle erupting between the two "designs" in the manufacture of test series.

The answer for ES2 lies "elsewhere" in the sense that the European firm is proposing the general solution of "silicon compilation + direct writing on photosensitive resin." This general solution couples rapid production of finished products with design flexibility.

The acquisition of Lattice Logic, located in Edinborough, bolstered the ES2 CAD software design staff, bringing the number of employees working in this area to 80; the "critical mass" needed to claim a competitive position has been reached. And it is thanks to these reinforcements that ES2 intends to offer to the market a behavior simulation system in 3 or 4 years.

For the moment, the firm now works with two silicon compilation software systems, Solo 1000 and 2000. The first, dedicated to random logic circuit design ("Glue Logic") can operate on a hardware architecture designed around the PC/AT (using MS-DOS) or on workstations working in a UNIX operating environment.

Solo 2000, developed in cooperation with SDA Systems, an American company, provides for the study of more complex custom circuits requiring the incorporation of compiled "macros" blocks formed of RAM, ROM, PLA, ALU and other precharacterized cells. This software can operate on most UNIX workstations. It is recalled that an OEM agreement was signed between SUN and EST under the terms of which the two companies agreed to set up a technical partnership for SUN3 workstations to support SOLO 2000 software (see ELECTRONIQUE ACTUALITES, 9 January 1987).

This ambition to supply test series to the client very quickly and logically led ES2 to adopt a policy of entering into agreements with large-volume manufacturers, such as the agreement with Texas Instruments/Philips/Signetics. It is recalled that under the terms of this agreement, ES2 will provide ASIC prototypes in a System Cell compatible process (CMOS 2 [micron] m) to the European customers of TI and Philips (see ELECTRONIQUE ACTUALITES, 23 January 1987).

Mr Demange likes to repeat that the advent of silicon compilation is similar to that of the microprocessor, in the sense that designers must radically change their manner of looking at and designing systems. But silicon compilation is scary, like ASIC design in general, because of the amount of money at stake and the difficulty experienced by the customer in controlling the design environment. The users must be completely reeducated, particularly potential clients of small and medium businesses and industries. ES2 is aware of the problem and has developed basic and advanced courses on Solo 1000 and Solo 2000. But this is insufficient when it is a state of mind that needs to be changed.

ES2 is already ahead of its time. The company hopes to reach gross revenues of 40 to 50 million francs this year and it is well on its way to meeting its goals. In any event, it believes that it will begin to show a profit as early as 1989.

12798
CSO: 3698/512

NEW ELECTRONICS TESTING EQUIPMENT IN SACLAY, ORSAY

Paris ELECTRONIQUE ACTUALITES in French 15 May 87 p 2

[Text] Two major research facilities valued at some Fr45 million and intended for use by the electronics industry will soon be installed several kilometers from each other, one at Orsay, the other at Saclay.

Construction of a space astrophysics institute (SAI) with a calibration station to provide construction and testing facilities for satellite subassemblies is scheduled to begin on the Orsay campus (Paris-Sud university) in June 1987.

The station will be made accessible to outside research teams; it will provide for simulation of the irradiation to which electronics equipment will be subjected in space. It will include a class 10000 cleanroom (but with class 100 zones) and will be supplied with X-ray and ultraviolet radiation by the brand new Super-Aco ring, an instrument for production of synchrotron radiation placed in service a few weeks ago at Orsay.

The SAI is scheduled to become fully operational in 1989 and will employ roughly 100 people. It represents an investment of Fr32 million financed by the CNRS, the CNES and the National Education fund.

The CEA and the CNRS recently decided to implement another major research facility scheduled to become operational within three years. It involves a nuclear microprobe unique to France that will be used to study of materials composition (S-C for example) on a much finer and more detailed scale than is now feasible with conventional electronic microscopes.

The facility, valued at approximately Fr15 million, will be equipped with a particle accelerator with 3.5 MV of power. The instrument will permit "identification" of details measuring one thousandth of a millimeter.

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CSO: 3698/512

BRIEFS

FRENCH CCD MARKET ACHIEVEMENTS--THOMSON-CSF and LETI (Laboratoire d'Electronique et de Technologie de l'Informatique, a French firm specializing in electronics and computer technology) have signed an agreement for joint development of the next generation of image sensors, based on use of new CCD fabrication technologies. CCDs (charge-coupled devices) are already playing a vital role in optoelectronics applications ranging from sophisticated satellite camera systems to the familiar photocopier, bar code reader and the recently heralded camescope. Cooperation with LETI will further strengthen THOMSON's foothold in the industrial electronics market. LETI's research laboratory in Grenoble has acquired extensive experience in developing charge transfer expertise, through coupling of CCDs with infrared detectors, and THOMSON's 12 years of CCD initiatives have been rewarded by the emergence of innovative in-house technologies and its leadership position on the European CCD market. More than half of the firm's output is now being exported to Japan and the U.S.; and its technologies have been chosen for implementation in important military and space exploration programs. State-of-the-art structures include a matrix of 576x720 pixels with 3 micron linewidths. The next stage in this evolution will be a 100x100 matrixrequiring submicron components. At the end of 1986, prototype CCDs with 4" substrates and 1.5 micron patterns had been built and were ready for transfer to fabrication. [Text] [Paris FTS--FRENCH TECHNOLOGY SURVEY in English Mar 87 p 6]

SPECIAL THOMSON COMPONENTS BRANCH--As we hinted in our last issue, Thomson-CSF recently set up a special components branch to be directed by Mr Jacques Caumartin, the current director of the Thomson-CSF Electronic Tubes division. The purpose of this branch will be to act as a supplier of strategic and professional components--emission tubes, imagers--to the military and aviation-aeronautics markets both in Europe and in the United States. The branch combines the Electronic Tubes division (DTE); Thomson Military and Space Components (discrete and integrated semiconductors for military use), a company based in St. Egreve, directed by Mr Rene Besamat; Thomson Hybrid and Microwave Components, managed by Mr Alain Berest, with four departments (Silicon and Gyromagnetism in Montreuil, AsGa in Corbeville, Hyperfrequency Microelectronics in Massy, Hybrid Circuits in Puiseaux); CEPE for quartz, based in Argenteuil and directed by Mr J. Caillliau; Thomson Sintra Hybrids founded in January 1987 and established in Marcq-en-Bareuil (Nord) with Mr Christian Leveque as its president/director general and Mr Gerard Leveque as

its president. In sum, the Special Components Branch will represent total gross revenues ranging from Fr2.5-3 billion with a staff of 5500. The Electronic Tubes division alone represents Fr1.6 billion in gross revenues and 3200 employees. Mr Henri Starck, president of Thomson-CSF, is also in charge of that company's overall professional components activities and is assuming management of LCC, whose president/director general is Mr Roger Agniel, and that of the Special Components Branch. He is also Chairman of the supervisory council of United Semiconductors (the temporary name of the SGS/Thomson S.C. entity). [Text] [Paris ELECTRONIQUE ACTUALITES in French 22 May 87 p 15] 12798

CSO: 3698/512

EAST-WEST TECHNOLOGY LEVELS COMPARED

Munich SUEDDEUTSCHE ZEITUNG in German 5 May 87 p 6

[Text] Bonn (AP)--The alleged inferiority of the Soviet Union compared to the West in key technologies is simply wishful thinking. This is the conclusion reached in the summary results of a study by the research institute of the Friedrich-Ebert Foundation of the SPD. According to the study the Soviet Union has gained a substantial lead in space research and technology, and in addition, it is also up to international standards in areas such as thermonuclear research, laser research, particle beam research, and molecular genetics. It does lag behind the West in information technology, communications technology, and mechanical engineering.

According to the study, this development is the result of the sanctions and embargoes which the West imposed on the East bloc and which had a bumerang, i.e. mobilizing effect starting in the early eighties. The fact that the achievements of the East bloc have so far lagged behind is not due to a lack of scientists or individual abilities, but to the research and science system which has been practiced so far and to the mechanism of a controlled economy which had a rather inhibiting effect on the introduction of new technologies.

According to data collected by the study, between 1976 and 1980 alone the Soviet Union sold 720 industrial licenses to the West, three times as many as it got from the West. The United States alone purchased 125 licenses from the USSR.

The study also points out that Ukrainian researchers have developed a computer for 200 million computing operations per second. Soviet scientists believe that they are now able to compete with the United States and to develop computers for more than 10 billion operations per second.

According to the study, the other CMEA countries are also trying to keep the gap to the West in the area of information technology from getting too wide. The study reports that in Hungary already 200.000 home computers are privately owned and 260 mainframe computers and 30.000 personal computers are owned by companies and public institutions. Even Bulgaria is producing personal and office computers today as well as laser robots for metal and wood processing.

With regard to the GDR the study reports that it decided in favor of the "most extreme form of a development strategy in the area of micro electronics among the CMEA countries". Large sums have been invested with the purpose of safeguarding independence from the West. Today, the GDR has facilities for the production of 1 megabit memories which are to go into production as early as during the current 5-year plan. The study says that 80 percent of the components are being developed in the GDR.

12831
CSO: 3698/537

EXTENSIVE CUTS IN INDIRECT R&D FUNDING AFFECT FRG INDUSTRY

Science Policy Perspective

Duesseldorf HANDELSBLATT in German 30 apr 87 p 6

[Article by "olb": "Small-scale Firms Receive More Support than Large-scale Businesses"]

[Text] Bonn, 29 Apr--A comprehensive aid plan intended to make research policy clearer was submitted on Wednesday by Federal Research Minister Heinz Riesenhuber. At the same time the minister also indicated the perspectives of future research policy.

The comprehensive aid plan submitted for the first time is supposed to improve the dissemination of information both to outside parties and also--along the lines of a management information system--for the purposes of decision-making in research policy. Riesenhuber indicated that in the research policy of the past legislative period new features were emphasized in addition to methodological improvements in research promotion, limiting the influence of the State in industry, and increased assistance to basic research. In the comprehensive aid plan, for the first time all the means of the Federal Ministry for Research and Technology for assisting research (project promotion, financing of large research institutions, and appropriations for international contributions) are shown clearly and according to thematic considerations. Furthermore, analyses on the promotion of research in industry, sectors for health and environment protection, long-term programs, and basic research have been described in accordance with unified criteria compatible with one another.

The minister stressed that in addition to the budget with its about 330 separate sections, with this an instrument is now available that serves in a clear and concise way to inform outsiders as well as serving the managing of research policy. Riesenhuber intends the abridged version now on hand to be followed by a comprehensive and detailed expanded version after the conclusion of the current budget deliberations in the summer of 1987. According to the minister, in the latter version the separate emphases of research policy will then be described with regard to their contents and in terms of the financial planning up to 1990.

In the just submitted aid plan it is shown, among other things, that in the past years the share of research and development financed by the businesses themselves grew constantly. He said that at present this share comes to about 60 percent. Thus, after Japan the FRG leads all other large industrial countries in this respect. The economic assistance grants of the ministry have been reduced in the area of market-oriented technologies, from DM 2.3 billion (1983) to only DM 2.03 billion in 1986. This reduction has concerned direct project promotion exclusively. In place of this, indirect programs have been expanded in order to include the small businesses more in research assistance.

That has been a success, stressed Minister Riesenhuber, who also said on this point: "For each mark that they themselves raise for research and development, at present small businesses are receiving twice the assistance funds, at about 16 pfennigs, from the Federal Government as do the large-scale businesses (equals about 8 pfennigs)." The share held by basic research in the budget of the research ministry has been expanded from about 26 percent to a good 35 percent. The share held by research on matters of quality-of-life protection (environmental and health research) in the budget of the ministry has grown by a good 20 percent.

Concerning the perspectives of research policy, Riesenhuber stressed that the Federal Government will continue to follow four principles:

- Freedom of research

- Restraint on the part of the state and the supporting of self-initiative

- Approval of technical advances with a minimizing of their risks, and

- Appreciation of aid and promoting of cooperation in research.

He said that these principles, among others, have been assimilated within the promotion of research in industry: Through restraint on the part of the state in the market-related sector, and instead concentration on framing basic conditions, and through target-specific supporting of new key technologies and of small businesses in the technological adjustment process. According to Riesenhuber, in the sector of quality-of-life protection one important task of governmental research policy is regarded by his ministry as lying in enlarging the supply of technologies and information available for coping with public problems, above all in the areas of health and ecology.

Indirect Funding Loss Harmful

Duesseldorf HANDELSBLATT in German 25 May 87 p 1

[Article by "na": "Small-scale Industry Rates the Plans on Economizing as an 'Unfriendly Act'"]

[Text] 23/24 May--The indirect research funding that is of benefit to small-scale businesses above all is to be largely discontinued or greatly reduced in the wake of the tax reform.

The employee costs subsidy program for research and development activities that was endowed with DM 400 million annually is to be discontinued at the scheduled time limit at the end of 1988. The pledges already given will be fulfilled, but from now on no more new pledges will be granted. On the other hand, according to information received by the HANDELSBLATT there will be a continuation of the program for assistance in the new hiring of additional research personnel in medium and small businesses, for which DM 70 to 80 million is allocated.

To be discontinued on schedule are the special depreciations for research and development investments timed to expire at the end of 1989. Also under discussion for financing the tax breaks is the cancellation of the tax-free investment allowance that does not have a time limitation. On the other hand, the industrial cooperative research funding unlimited in time not only is to be continued, but is possibly even to be expanded.

No Decision Yet on the Investment Allowance

The annual costs for the research allowance, the special depreciations, the employee costs subsidy program, the employee costs increase program, the industrial cooperative research funding, and the program for assisting the founding of technology-oriented businesses add up to DM 1.4 billion. If the fixed-period assistance measures were to be discontinued on schedule, this would reduce the costs to the government by DM 870 million annually after 1989. The cancellation of the investment allowance would bring an additional DM 430 million. No decision has been reached yet on the investment allowance. Negotiations are going on concerning this as well as concerning the freezing of the research expenditures of the Federal Government at the present level intended to be pushed for by the Federal Ministry of Finance during the top-level talks on preparing the 1988 federal budget.

At its small-business conference in Berlin, the Federation of German Industrialists had forcefully pointed to the dangers of the cancellation of research assistance oriented to small businesses in the wake of the planned decrease in subsidies, and had appealed to the Federal Government to continue the instruments of indirect research promotion even after the expiration of their time restrictions.

Small-scale industry fears that in a discontinuation or in a marked reduction of indirect research funding, the ratio between indirect funding and project promotion, which the present Federal Government had improved to 1:2, will worsen again. In small-scale industry circles this would be viewed as an "unfriendly act" if by way of the cancellation of research subsidies beneficial to it small-scale industry were to be taken advantage of for the sake of financing a tax reform that eases its own burdens hardly at all or only minimally.

Losing Indirect Funding

Duesseldorf HANDELSBLATT in German 25 May 87 p 2

[Editorial by Rainer Nahrendorf: "Turned Topsy-turvy"]

[Text] In the search for sources of financing for the tax reform, Gerhard Stoltenberg stands alone. The ministries act mostly in accordance with the "pass-the-buck" principle. Now, when it is no longer the tasty bacon but the indigestible rind of reform that is coming into view, the tax reform is proving to be a box of tricks, at least for small-scale industry. Whereas FDP financial expert Solms projects the "tax reform boons" for businesses to be several billions of DM, the calculation of the Federation of German Industrialists turns out to be far more modest. The temporary freezing of the trade tax rates of assessment brought into the discussion by Solms is hardly more than a nice colorful balloon that will burst in the raw wind of municipal financial autonomy.

For small-scale industry, it is all the more annoying that the indirect assistance beneficial to it is to be largely discontinued. In view of the relatively slight relief it will get within the framework of the tax reform and its extra burden due to subsidy cancellations that affect it especially, small-scale industry sees itself as the sacrificial lamb of redistribution. If the indirect research funding should really largely cease, it is not only the assistance philosophy of the Federal Government that would be turned topsy-turvy. There would remain also the unpleasant impression that research subsidies are being cut back and subsidies to maintain ailing industrial branches are being increased. This can hardly be described as providing for the future.

12114
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FINLAND'S BIGGEST TECHNOLOGY CENTER BREAKS GROUND IN TURKU

Government Support Promised

Helsinki UUSI SUOMI in Finnish 9 Jun 87 p 9

[Article by Ritva Kankamo: "Holkeri Promises to Support High Technology: 'The Finns Have to Learn How to Sell'"]

[Text] The Administration will support high technology. In Turku on Monday Prime Minister Harri Holkeri promised governmental support for high technology projects if they have good chances of success.

According to Holkeri the new Administration is putting a record amount of emphasis on research. Citizens have a promise to expect action by the Administration to strengthen the country's competitiveness in the field of high technology too.

Holkeri talked about high technology while laying the cornerstone for Finland's largest technology center.

Holkeri urged Finns to learn how to sell, because success in high technology markets requires not only extra volume but also extensive marketing and recognized trade marks.

Universities Should Take off Their Three-Piece Suits

Concerning the readiness of the universities to respond to the challenges of the scientific community Holkeri said, quoting the remarks of some professor, "Our university institutions are going around in a three-piece suit from the 1950's. It is durable, stiff, unfashionable and not very attractive. In its place we need the loose-fitting, fashionable attire of the 1990's."

Holkeri emphasized closer cooperation than at present between the universities and industry and a reversal of the brain drain or the return of Finns who have gone elsewhere and the arrival of foreigners in Finland.

West Finland in the Lead

On Monday the roof raising ceremonies for Datacity I and II were also held. The costs of the first three stages of Datacity, which is being built by Perusyhtyma Oy, J Lunden Oy, are about 200 million markkas; the fourth stage, Biocity, will be started in 1989-90.

According to Minister of Government Ilkka Kanerva, Datacity will raise West Finland to the top in information technology. The region already has 70 percent of Finland's communications industry and 40 percent of the electronics industry. Datacity is Finland's largest technology center and the first one to be set up without any governmental investment to speak of.

He recalled what had already been accomplished in Turku.

The New Technology Foundation has completed a research policy program, the VTT's [Technology Research Center of Finland] Turku branch is obtaining funds for establishment, discussion has been started on a chemical center, research in electronics has been started with the aid of an endowed professorial chair and Finland's first project involving the European space program is in the final stage at the Wihuri Physics Research Institute.

Road to Space is Opening

More details about ESA's European space program were related by Docent Jarmo Torsti, who said that the Finns now have their first opportunity to participate in the space race.

"In the equipment planning for two satellites the Finns are along with 4-5 proposals, one of which is 100 percent Finnish. If Finland gets the responsibility for implementation, the network of our companions in cooperation will expand both to other universities and to high technology companies," Torsti said.

PHOTO CAPTION [Photo not reproduced]

Prime Minister Harri Holkeri from an administration exceptionally friendly to research laid the cornerstone for Finland's largest technology center on Monday in Turku's "Silicon Valley."

Development Corporation Established

Helsinki UUSI SUOMI in Finnish 11 Jun 87 p 11

[Article by Ritva Kankaanpo: "Development Corporation Backs up Turku's Datacity"]

[Text] To support Turku's Datacity, Finland's largest technology center, a development corporation was founded on Wednesday with the objective of obtaining enough capital to ensure Datacity's development requirements within

three or four years. The minimum capital of the development corporation is 10 million Fmk and the maximum 50 million Fmk.

The company's shareholders include Farmos, Huhtamaki, Mancon, Pohjola, Sampo, Perusyhtyma, several banks, as well as the Turku School of Economics' support foundation and Abo Academy's foundation.

According to the spokesman for the development corporation, Managing Director Jussi Kaistin, the ownership basis will be expanded. Shares may be subscribed during June, when the shareholders' meeting establishing the corporation will also be held.

Datacity Advance will concentrate on high technology enterprises. It will be especially active in the fields of biotechnology, electronics and computer technology. It will act as a broker for operating companies and their shares, help in the implementation of product ideas, build new groups of companies, develop international cooperation and assist in financing.

The first stage of Turku's Datacity will be completed in the fall.

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DEKKER: COORDINATE NETHERLANDS R&D, MARKET, AID SMALL FIRMS

Duesseldorf HANDELSBLATT in German 2 Jun 87 p 37

[Article by Wisse Dekker, Chairman of the Netherlands Advisory Panel for Technology Policy: "Better Interface Between Research and the Market--Small and Mid-size Enterprises Need More Support"]

[Text] Last fall the Netherlands government asked a high-powered group of industrial managers to draft a new technology policy concept for the government. Wisse Dekker chaired the panel. In the past there has been widespread criticism of the existing concept, both inside and outside the country. The Dekker Panel's report, which was submitted in late April, will be the subject of parliamentary debate next summer. Inasmuch as both the government and the opposition have reacted positively to the report, it is safe to assume that its basic features will be incorporated in the country's future technology policy.

Technological development is increasingly assuming an international character. The Netherlands' technology policy will have to take this fact into account. The tempo of technological development is greater than that of its application. In a number of areas developments occur at such a rapid pace and are so fundamental, that we can no longer speak of "adaptation," but rather of "transformation." To be adequate, a technology policy will have to take this speeding up of processes of change into consideration. Internationalization and a rapidly increasing research intensity constitute the background against which the panel formulated its technology survey in late April.

What then constitutes the problem concerning development? It is not so much the accessibility of technological knowledge, but rather primarily the efficiency and speed with which this knowledge is transformed into useful, profitable products and services for the benefit of society. This is particularly evident in medium-sized and small enterprises: they lag behind the know-how level of large and multi-national enterprises. For this reason the panel devoted particular attention to mid-size and smaller enterprises. The only way we can maintain and strengthen our international competitive stance is for the grand total of all enterprises to participate actively in the technological revolution and for them to absorb and digest changes occurring at a rapid pace.

The title of the technology report is "Mutual Exchange Between Research and Marketing." There was a reason for choosing this title. It illustrates the need for a considerable strengthening of the interface between the links in the chain from research to usable products (and services). That is the challenge facing the Netherlands' technology policy.

An improvement in the interface cannot be forcibly brought about by a central source. Initiatives in this respect must originate primarily with the participants in the process of technological innovation: schools, research institutions and industry. They are the ones which must cooperate closely to convert technological innovations into practical operation.

The role of the state is restricted to mobilizing the participants of this process. Technology policy must also contribute toward creating greater continuity among its activities and toward creating solid networks between them. The Panel defined its technology policy as a coordinating structure. In doing so, the national advisory body for technology policy and the implementing agency play a key role in close cooperation with the regional innovation advisory centers. To attain the desired goal of an improved interface between knowledge and marketing, a great number of proposals were made. I should like to illustrate this by citing some examples. First, we must agree that in the final analysis technological innovation exists for the benefit of the human society. Technological innovation can be successfully pursued only if society has a great enough need for it. People must be prepared to accept change and must learn how to deal with it.

Training and education constitute the basis for any technology policy. Well-trained people, acting as "repositories of knowledge" play a key role in all phases of technical innovation. The educational level of our population must be raised quickly. Great emphasis should be placed on training the currently active workforce. There is no time to lose. The interdependency between training and the market demands that the self-renewing capability of training must be adequate to meet increasing challenges. Further deregulation is desirable to accomplish this. More opportunities must be provided for financing as well as for working conditions in educational institutions to create self-starting initiative. The number and quality of university graduates must show a considerable increase. A decrease in the number of dropouts as well as greater participation by women is essential.

Research institutions in the public sector have an important part to play in technological innovation. Public sector research institutions should increasingly function as "research factories:" a sort of subcontractor for knowledge and initiative, operating like a plant which focuses on the interests of the consumer. Precise location finding and market-oriented identification of technological institutions is important. Higher-quality, useful research should be stimulated. It would be useful also if the universities were to operate increasingly as "research factories." Current legislation provides many useful opportunities for this. The availability of research equipment also requires attentive study; considerable improvement is needed in this area.

There is a need for more effective dissemination of knowledge, to enable small firms to absorb and apply available information. There must therefore be an increase in the capability of small enterprises to absorb new knowledge. The majority of small enterprises has a need for information transfer through intermediaries. This is the reason why the Netherlands' advisory structure must be strengthened and better oriented toward the transmittal of technological knowledge. Knowledge transfer must meet three criteria: speed, simplicity and proximity. We are advocating a network of regional innovation advisory centers. These centers would have the following responsibilities:
--to conduct educational campaigns and to serve as reference sources for new technologies;
--to conduct liaison between small enterprises and sources of information;
--to promote active knowledge transfer;
--to provide any stimulation and assistance required by small enterprises.

Technology policy must be effectively and professionally implemented. This could best be accomplished by an independent agency. This agency would work entirely under the direction of the minister of economic affairs, but should also have implementing authority for other departments. Persons responsive to matters of technology policy would thus occupy a controlling position.

The Netherlands have no need for a totally new concept of technology policy. A turning point in thinking on technology occurred a few years ago. An improvement in technological policy mostly involves mobilization and organization, with some additional government funding. The total expenditures would amount to about 550 million guilders per year, which is about 10 percent of the amount spent by Netherlands enterprises for research and development. The pace of technological development and the ensuing drastic effect on coexistence require an effective policy. As far as we are concerned, the guidelines for creating it are now available.

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BRIEFS

FRG-NETHERLANDS JOINT RESEARCH--The two largest European organizations for contract research, the German Fraunhofer Society and the Dutch Organization for Applied Scientific Research (TNO) want to cooperate more closely in the future. They decided on an extensive information exchange, mutual use of operating means, and an increased exchange of scientists. In the future, the cooperation in national and European research projects will be coordinated jointly. This first cooperation treaty will initally be valid until the end of 1990. Both organizations have comparable financial means and operate the same number of institutes. [Unattributed article: "Closer European Research Cooperation"] [Text] [Frankfurt/Main FRANKFURTER ALLGEMEINE ZEITUNG in German 6 May p 32] 12831

ELORG-DATA'S NEW SHAREHOLDER--The Kansa group will become Oy Elorg-Data Ab's newest Finnish shareholder. Elorg-Data's shareholder meeting confirmed the agreement that had been negotiated. Kansa will become Elorg-Data's second largest Finnish shareholder, according to an announcement on Wednesday by the Kansa group. The other Finnish shareholders are Nokia, Kansallispankki and Teboil. The Elorg-Data shareholders meeting appointed Kansa's managing director Matti Packalen as a new member of the board of directors. Kansa and Elorg-Data have been cooperating in the computer services area for several years already. [Article: "Kansa Joins Elorg-Data"] [Text] [Helsinki HELSINGIN SANOMAT in Finnish 11 Jun 87 p 31] 12893

CSO: 3698/539

BRIEFS

ITALIAN ADVANCED MILITARY EQUIPMENT SOLD TO THAILAND--Bangkok, 25 March 1987--Various interesting contracts for the major Italian companies are in advanced stage of negotiation on the markets of Southeast Asia. Agusta, for example, is about to conclude an accord with Thailand for the sale of four AS 61 customized helicopters for the transport of the king, ministers, and military chiefs of Thailand. This is a type of helicopter already in use in Italy by the pope and the president of the republic. Selenia, on its part, has obtained a license from the Italian Ministry of Foreign Commerce to sell the Thailandese army a $40 million "spada' antiaircraft battery system. Aeritalia, on the other hand, is intensely involved in negotiating the sale of G222 transport aircraft and aircraft equipment to the Thailandese air force. Officine Galileo may also, within the year, conclude with Thailand the sale of a $1 million Vanth optronics fire control system to modernize antiaircraft artillery. [Text] [Rome TELEINFORMATICA 2000 in Italian 25 Mar 87 p 4] 13120/6091

OLIVETTI SELLS PC FACTORY TO PRC--A factory for the production of Olivetti M 24 personal computers, modified to handle Chinese characters, was inaugurated at Kunming, in the south of China. [Text] [Milan NOTIZIE FLASH in Italian 10 Mar 87 p 6] 13120/6091

CSO: 3698/476

EQUIPMENT NEEDED TO SUPPORT GDR BIOTECHNOLOGY

East Berlin FERTIGUNGSTECHNIK UND BETRIEB in German No 4, 1987 pp 235-6

[Article by W. Kauruff, engineer, KDT [Chamber of Technology], VEB Chemical Plant Construction Combine Leipzig-Grimma and G. Haase, teacher, KDT, KDT Presidium, Continuing Education Division: "Biotechnology's Demands on the Metal-Processing Industry"]

[Text] 0. Introduction

As the importance of biotechnology for the modernization and intensification of production continues to increase, its accelerated development in all phases of the production process is of enormous importance for an effective policy of innovation.

The conclusions of the 11th SED Conference support and confirm the route that has already been followed for years in the GDR of developing biotechnology on all fronts.

The 11th Congress's directive for the 1986-1990 5-Year Plan consistently formulates the tasks standing directly before the metal-processing industry for intensified development and application of key technologies:

"In the field of biotechnology, futher advances must be made in effectively utilizing the present production potential through modernization, rationalization, and the directed expansion of capacities...

"Biotechnological production should be tripled in the period extending to 1990. Decisive requirements for this are to be met with the concentration of research potential and with the mastery and application of biotechnology's modern work techniques, in conjunction with process engineering and automation based on an advanced knowledge of microelectronics.

"The streamlining of capacities for modern equipment and plants, including research technique for biotechnology...must be accelerated."

Based on the current good experiences (for example, chemical plant construction, separator construction, laboratory technique, and the construction of scientific instruments), fundamentally new considerations are

needed for effectively supporting the development and introduction of biotechnology on the part of the metal-processing industry and for organizing and implementing a significant impetus in this area.

The goal of this article is thus to show those active in the metal-processing industry the demands that this key industry of biotechnology poses the metal-processing industry.

1. Biotechnology's Tasks

In recent years, revolutionary discoveries and inventions have been made in the biological sciences and related disciplines, which make it possible to wrest nature's secrets away from her and make them useful to humanity.

At stake are the purposeful development and industrial utilization of living organisms and biological agents for producing specific products and services. This new scientific field, which distinguishes itself in its highly dynamic progress in knowledge and technology, is biotechnology.

What is biotechnology?

Biotechnology is the application of highly specific capacities of biological systems (biological systems are microorganisms, plant cells, animal cells or parts thereof) to technical processes with the goal of industrial production of improved or wholly new products and the preparation of specific services. (Footnote 1) (Training material. "Lectures for Party Cadres on the Application of Key Technologies." Publisher: SED District Administration Gera, 1986, pp 38ff.)

This definition, which is likewise a formulation of the task, makes it clear that not only the fundamental, scientific mastery of biological systems, but also close integration of biological and engineering sciences, a high level of inter-, even multi-disciplinary cooperation, close cooperation between diverse branches of industry and economic fields, and a high level of technology are prerequisites to the industrial utilization of biotechnology.

Biotechnology thus permeates all areas of our economy and is applied in the chemical and pharmaceutical industry, in the food, fodder and drink industry, in the paper, textile and photochemical industry, in agriculture and water conservation, in the development of raw materials, and in environmental protection.

And even today, new, truly revolutionary fields that will achieve great importance are being suggested, e.g., gene and cell culture technology, biocomputer technology, etc.

Biotechnology is making it possible to develop a new materials economy that will contribute to essentially higher economic productivity and efficiency.

Since every country's scientific and technical potential is economically limited, all the promising lines of development cannot be worked on by a

single country with the necessary breadth and depth. Thus, the international, socialist division of labor in the CEMA framework assumes particular importance. Along with their own basic research (specialization), close cooperation between the CEMA member countries must be achieved in order to refine and exchange new experiences in basic and applied research and to put them to practical use without delay.

That biotechnology was one of the five main directions for complex cooperation agreed on in the "Complex Program for Scientific and Technical Progress of the CEMA Member Countries Through the Year 2000," completed in December 1985, is a visible expression of this.

The determination with which biotechnological knowledge can be obtained, examined and made economically useful in the combines and plants of the aforementioned branches of industry and economic fields and in the institutes of the universities, colleges, the Academy of Sciences and the Academy of Agricultural Sciences is essential to scientific and technical progress and its tempo in the field of biotechnology.

The engineering-technical side, and so also the metal-processing industry, the equipment and plant construction industry, assumes great importance in the development and continuing development of new and currently employed biotechnological processes--be it at the level of laboratories or experimental plants or in putting them into production. Attaining high productivity and efficiency depends on granting every assistance to the microbiologists, geneticists, biochemists, biophysicists, process engineers and others responsible for biological processes and products, above all in

- the development and manufacture of modern, high-efficiency instruments, means of automation, apparatus and equipment;

- the development of complete subplants and technological lines;

- the introduction of modern methods and approaches in research, planning and plant construction, e.g., CAD/CAM systems, robot technology, modern measuring, guidance and control technology;

- the investigation of optimized plant structures, of the industrial behavior of the instruments, apparatus, and sub- and complete plant lines employed in biotechnology.

It is obvious from these demands that biotechnology must develop a partnership with all branches and fields of the metal-processing industry. Here, the metal-processing industry should function initially as the developer and producer of instruments, apparatus, equipment and subplants for biotechnological processes, while the construction of complete plants or specific subplants is, and will remain, a central task of the chemical plant construction industry.

A basic requirement for all biotechnological processes is to guarantee and maintain the living conditions of the microorganisms and the quality and

activity of biological material in the reactor space and, in part, also still during the refining processes. This requirement yields some important consequences for the direction of biotechnological processes and the form of the guidance and control systems, which are particularly essential to the technologies that operate under sterile conditions, especially for highly refined, low-yield products.

2. Biotechnology in the Metal-Processing Industry

Therefore, the GDR's metal-processing industry can and must decisively contribute to fulfilling these demands of biotechnology with its R&D potentials and its own capacities for rationalization methods and model building.

Particular attention must be paid to the development and production of instruments, apparatus, and equipment specific to biotechnology, without which biotechnology cannot develop into a key industry. These are, for example,

- bioreactors (fermentors, enzyme reactors, etc.);

- equipment and accessories for special refinement operations (special separators and driers, preparatory chromatography systems, membrane materials for separation of biological material, etc.);

- apparatus for sterile technology, like armatures, air filters, pumps, cleaning technology, etc.;

- specifically designed enzyme sensors, as well as sensors, instruments and guidance systems for the biological signals of microorganisms, cells or parts thereof;

- instruments, apparatus, and equipment for experimental fields (laboratories, technical institutes, experimental and pilot plants);

- complete, highly automated, exportable plants, subplants, and special equipment, as well as simple technologies for decentralized utilization of raw materials, especially in agriculture.

In addition, optimal standards for selection of material and protection against corrosion must also be formulated and implemented.

- For this reason, researchers and developers, designers, planners and technologists, electronics experts, measurement, guidance and control technicians, automation technicians, material specialists and other cadres of the metal-processing industry are called upon to familiarize themselves with the fundamentals, tasks, and approaches of biotechnology so that they will be in a position to develop and build such technical means as can take biological systems into account.

  The metal-processing industry will also increasingly become a direct beneficiary of biotechnology, since it will be able to apply its results to its own production process, e.g., biological cleansing of waste fluids and

gases, including reclaiming valuable materials (contributions to low-waste technologies and recycling), in the use of biocatalysts for specific reactions, etc.

- An appeal is thus made to the heads of plants, departments and institutions to take care that the metal-processing industry's spiritual and material potentials become fully effective for biotechnology.

- Members of the KDT in the plant sections of the metal-processing industry, under the direction and with the aid of their executive committees, should contribute to:

  - helping to organize socialist teamwork between the biological and technical sciences;

  - becoming effective as collective leaders, guardians, sponsors and advisors, or in groups of experts, in order, for example, to give effective technical assistance to young researcher collective that are active and biotechnology;

  - organizing continuing education courses to teach the basics of biotechnology;

  - becoming involved in the specialist organs of the district executive committees or the specialist unions and the WTG [Scientific-Technical Society] of the KDT that are occupied with biotechnological task, and so cooperating across combine, district, and ministerial boudaries.

3. Summary

Although biotechnology in the GDR has already had a string of successes, there are still many problems with apparatus, instruments, and control technology to be solved or attacked, as well as work on planning and organizing plants.

The connection of biotechnology to other key technologies, above all to microelectronics, is indispensable here and will bring the decisive breakthrough in the time to come. The KDT, as a socialist engineers organization with its 280,000 members, has to make a decisive contribution here.

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CSO: 2303/33

GDR INTERVIEW WITH JAPANESE BIOTECHNOLOGY SPECIALIST

East Berlin SPECTRUM in German No 12, 1986 pp 5-7

[Interview with Non-Resident Academy Member Saburo Fukui, Kyoto University, by Elisabeth Manke; date and place not specified]

[Text] [Introduction] "Bio-Teku" in Japan"--"Bio-teku" is the Japanese jargon for biotechnology. It plays a key role in today's science and industry in Japan. It is of interest also in conjunction with electronics.

[Biography] This year Professor emeritus Saburo Fukui, born in 1919, was elected a non-resident member of the GDR Academy of Sciences. The photograph shows him receiving the diploma from the president of the Academy.

Saburo Fukui graduated from the Kyoto University Faculty of Engineering in 1942, where he served as assistant professor for many years. from 1954 to 1961 Professor Fukui worked for Himeji Polytechnic, where he acquired valuable industrial experience, before once again taking a professorship at Kyoto University until 1983.

He became professor emeritus in 1983; his activities since then include serving as visiting professor at the University of Compiegne, France and the Federal Technical University of Zurich, Switzerland.

Professor Fukui is an associate editor of eight international journals, among them the ACTA BIOTECHNOLOGICA, published by Akademie-Verlag.

[Acknowledgement]

We thank Dr Reinhard Renneberg of the Central Institute for Molecular Biology for his assistance.

[Question] One of your interests concerns immobilized enzymes and microorganisms. What specifically do you find fascinating in this area of research?

[Answer] Enzymes are simply amazing, when you consider their role in the life of organisms. They make possible a great variety of specific chemical reactions within the cells--and within an extremely short time, at that! Thousands of processes are occurring within the cell, which are interrelated in many different ways. The enzymes serve to produce an

enormous variety of cell building materials out of external nutrients. This capability of the enzymes is doubtlessly based upon their composition and their internal structure. This constituted my field of research for many years. But I had always been tempted to transpose their method of operation to other systems, to exploit them elsewhere.

In this we were faced with a problem: in their pure form, enzymes are not very stable. While there are some existing in nature which can exist under extreme conditions, industrial use requires general stability and, equally important, reusability. In the final analysis, our solutions must be economically feasible, if industry is to be interested.

For this reason, we proceeded as follows: we simply tied the enzymes to artificial carrier materials or membranes or enclosed them in gels, so as to immobilize them. In that form, they have the great advantage of becoming reusable, e.g. capable of being filtered out.

To come back to your question, it is difficult to say what attracted me originally to the immobilized enzymes--the hope of gaining a detailed insight into the mechanisms of enzyme catalysis, or the opportunity of making enzymes technically exploitable.

By now, biotechnologists all over the world are investigating these techniques, using a great variety of approaches: some, for example, choose director chemical bonding to the carrier or stability by using electrostatic forces or absorption. Also, the enzyme molecules can be combined by using a variety of reagents; they can also be mechanically enclosed in microcapsules. These immobilization techniques, which can be used also for microorganisms, as well as plant or animal cells, permit an unlimited use of enzymes. Cell immobilization now also permits the use of entire, often very complex, enzyme chains and metabolic processes for industrial purposes. Appropriate choice of carrier materials facilitates obtaining the desired properties. The technological and economic advantages of immobilized enzymes, compared with soluble ones, are enormous. Apart from reusability, they have greater stability when faced with high temperatures as well as a changed pH range. Immobilized enzymes can also be brought into contact with organic solvents without being inactivated. Cells which would normally die in organic solvents are protected by immobilization and are stabilized. This permits easier solubility of materials such as fats which are hard to dissolve, and their conversion by enzymes or cells. In our country, this is the way we produce the mint-like flavoring substance menthol and cocoa butter.

[Question] What other opportunities do you visualize for the technical use of enzymes?

[Answer] You are surely aware of the fact that Japan is poor in raw materials. We must import all our energy sources. Our industry is concentrated in a small area, which has in the past led to environmental pollution. Agricultural production must also be conducted very intensively within a relatively small area. We have today many more elderly people than before, because of the great increase in life expectancy; we thus require new and effective medications for use against such diseases as diabetes and cancer.

The enzyme technology branch of biotechnology offers new approaches to the solutions to all these problems. Enzymes are opening up "renewable" sources of energy and raw materials and make extensive use of them; in this manner we produce animal feed, basic industrial materials, alcohol, and new low-calorie sweeteners; we modify antibiotics for use as "molecular scalpels" by genetic engineers.

[Question] Does that involve a complex technology?

[Answer] Judge for yourself from this example: in simple terms, we pour a sugar solution into a steel tube filled with plastic balls, alcohol runs out the bottom. The reason for this is that living yeast cells are enclosed in the porous plastic balls. The yeasts had been immobilized; they cannot escape from the balls and in fact increase in number to the limit of available space. However, their nutrient sugar penetrates the pores into the center, and alcohol, their metabolic product, leaves the balls. Compared to the traditional biological alcohol process, in which the yeasts float freely in fermentation tanks, the new procedure is ten times more productive. Alcohol produced in this manner "reproduces" itself, in a manner of speaking. When I became interested in the technical use of enzymes many years ago, I had no idea that their usefulness is as varied as it is. They are increasingly becoming a part of Japanese everyday life.

[Question] Technical conversion must of course be efficient.

[Answer] That is an important point. The use of immobilized microorganisms can be considerably expanded by genetic engineering. This involves many more future tasks, whose extent cannot be fully visualized today.

The Japanese "Bioreactor Project," supported by our government, involves a number of areas which are jointly being researched by scientists and industry.

We feel that the development of biosensors is of great importance. It is one example of the combination of microelectronics and biotechnology. Biosensors use bioactive materials (e.g. enzymes) to make specific identification of a certain substrate. Chemical reactions incident to this lead to changes which are coded into an electric output signal and which are amplified electronically. Biosensors combine in themselves the high selectivity of biologic systems with the signal sensitivity of electronics. Even today we are successfully using biosensors in clinical laboratories, to monitor biotechnological production processes and for waste water control. Even "enzyme chips" are being tested.

[Question] What prospects do you foresee beyond the current millenium for enzyme technology?

[Answer] This technology is preparing to open up an entirely new branch for the chemical industry. Procedures which can today be accomplished under high pressure and high temperatures can be replaced by enzyme-technological processes which take place at normal temperatures and therefore require less energy. Specific enzymatic synthesis of complex

biological substances such as antibiotics, vitamins, prostaglandins, neuropeptides and cofactors will be one of the most important tasks for enzyme technology. We are on the way towards discovering entirely new areas. Production of aromatic and flavoring materials is possible, as is the elimination of undesirable tastes of specific products. The new sweetener Aspartame, for instance, is already being produced enzymatically by a Japanese firm. My colleague from Kyoto, Prof H. Yamada, will in fact report during a colloquium at the Central Institute for Molecular Biology about large-scale production, using a new type of enzyme, of the multi-purpose plastic Acrylamide, in an environmentally protective and energy-saving manner.

As I have already mentioned, I believe that immobilized systems hold great promise in the conversion of fatty substances having poor water solubility. Immobilized enzymes can be introduced into organic solutions, thus not only preventing undesired hydrolyses, but also synthesizing new types of substances, by "reversing" the direction of the reaction.

We have far to go to exhaust the many new opportunities for using immobilized enzymes and cells. But it is obvious that they will play an important future role in our daily life, in medicine and industry.

[Question] This year you were elected a non-resident member of the GDR Academy of Sciences. How do you feel about this?

[Answer] As a scientist I see value in our work for the purpose of improving the living standard of mankind. This however can be accomplished only in a world without war. For this reason I consider contact and cooperation with colleagues in other countries--including states with a different social order--to be not only an exchange of expertise, but at the same time a contribution toward preserving the peace.

For this reason I consider it a great honor and joy to have been elected a member of the GDR Academy of Sciences. There have been close contacts between your institutes and our university for many years. We are jointly working on tasks which I have described previously. Our joint endeavors are very effective in linking our know-how in enzyme and cell immobilization with the biosensor techniques of our GDR colleagues. This is useful to both sides.

I have visited the GDR several times in the past. One of my most vivid memories is of the Leipzig Biotechnological Symposium 4 years ago, to which I had been invited by Professor Manfred Ringpfeil.

And today I am greatly looking forward to our joint seminar on biotechnological problems, which will be held right after our talk in the Central Institute for Molecular Biology of the GDR Academy of Sciences. Just yesterday we attended the first part of the seminar in the Leipzig Institute for molecular Biology of the Academy of Sciences.

Japanese and GDR scientists will communicate about their achievements and will present their prospects for the future. In my lecture I plan to present a survey of the status of biotechnology in Japan; in addition, I want to present a few new biotechnological procedures which will replace traditional, environmentally detrimental ones. I am looking forward to the presentations of the colleagues from the GDR. Especially those on subjects of applied enzymology, including biosensors, and the conversion of hydrocarbons. I am eagerly looking forward to hearing the results. We hope that such biotechnological meetings will be organized at more frequent intervals.

[Question] As a world-class scientist you are also an academic teacher. How important do you think imagination is for creating scientific ideas and in training your students?

[Answer] I have so far trained about 200 students in my subspecialty. Half of them obtained their doctorate degrees, and most of them work in the Japanese biotechnology industry. I am very pleased about this, because it appears to confirm the correctness of our teaching concept.

The way it works generally is that I pass on a rough concept of my thoughts and ideas or hypotheses to the students. I do this to stimulate their imagination, which I believe is very important, and to provoke creative thinking. However, this can work for the long term only if we also work together on "serious" projects at the same time. This often extends the working day into a working night, which does not bother us. Finally, we must remember also that [illegible] contact between teacher and student extends even into their private lives. In my opinion this approach has a positive influence upon scientific dialogue. In the final analysis, today's research is successful only if it manages to create a scientific successorship which builds on the results obtained and which will be capable of making new discoveries.

Photo Captions

1. p 6. "Biotechnology," as written in Japanese.
2. p 7, left. A vision of the future: a biosensor robot.
3. p 7, right. Graphic representation of "alcohol acid."

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DEVELOPMENT OF TELECOMMUNICATIONS IN YUGOSLAVIA

Coburg MIKROWELLEN & MILITARY ELECTRONICS MAGAZIN in German Dec 86 p 500

[Article entitled: "Yugoslavia Expands Telecommunications"]

[Text] In the 1986-90 plan period, Yugoslavia intends to invest a good 500 billion dinars in its telecommunications services, calculated in terms of 1985 costs. Some 420 billion dinars of this are earmarked for expanding telephone traffic. This investment budget was approved by the administrative council of the Yugoslav Postal and Telecommunications Company PTT. However, this did not silence critics of these projects. They are still considered as too ambitious and insufficiently coordinated.

Among the investments, domestic main connections and international transfer connections will be given priority. Approximately 140 billion dinars have been earmarked for this subsector. In the past few years it had been neglected in favor of the local telephone networks. The main line of a new domestic coaxial network, the so-called central network, is just about finished. Some 87 percent (2,150 km) has been laid. The next step now is the purchase of equipment --primarily from abroad--to complete the work which is supposed to be finished at the end of next year. By 1990 then, the secondary networks will be hooked up to the central network.

In 1988 the third satellite ground station is supposed to become operational. Investments amount to about 3.5 billion dinars. The station is a component of the Eutelsat communication system. In 1990 Yugoslavia will then have an added capacity of 600 telephone channels in inter-European satellite telephone traffic. The two existing stations are connected to the Intelsat system for intercontinental connections. Construction of two additional ground stations after ' `0 is included in the planning, specifically one each for the Intelsat system and the Inmarsat system.

In domestic telephone traffic the level of supply with telecommunications-main trunk stations is supposed to increase from 14 lines per 100 inhabitants at the beginning of the year to a ration of 17 per 100 at the end of the 1980's. At the same time the introduction of private radio telephone traffic is being pushed forward. The first phase of expanding this network is to be finished in 2 years. Then it will be possible to service about 100,000 subscribers. This should meet the existing demand for automobile telephones and telephone

traffic in sparsely populated regions. Domestics suppliers are Nikola Tesla (Zagreb, Croatia) with a Swedish Ericsson system. In addition, in its Teas Temko factory in Skopje (Macedonia) Makpetrol is preparing to start production in collaboration with the Canadian SR Telecom conglomerate.

In the traditional sectors of telephone communications the market is divided up strictly in terms of the dominant regional manufacturers. In each case these operate under various foreign licenses. Automatic public telephone centrals are currently offered by Nikola Tesla (Ericsson system) and Iskra from Kranj, Slovenia (ITT and BTM licenses, respectively). In addition, El-Nis (Serbia) with a GTE system from the United States and Energoinvest from Sarajevo (Bosnia and Hercegovina) with a French Schneider system are pressing into the market.

Coin-operated telephones are produced by El-Pupin (Belgrade/Zemun) under an Autelca license from Switzerland and Iskra (BTM). Both companies want to offer credit card and magnetic card telephones in conjunction with Autelca. Multiplexer equipment, which is used in the PTT network, to the extent it is not directly imported, comes from four domestic manufacturers: El-Zemun (in cooperation with Siemens), Iskra (SEL), Nikola Tesla (Tellettra) and Unis from Mostar (Ericsson). The companies want to expand greatly their assortment and production over the medium term and direct their attention to the requirements of PTT.

At present cable production for PTT requirements is distributed among four manufacturers. In Serbia production is by Fabrika Kablova (FK) in Zajecar and in Svetozarevo. In addition, Elka from Zagreb and Novkabel from Novi Sad (Voivodina) are active in this sector. The three last-mentioned manufacturers are also planning to get into the glass fiber business. At first, foreign products are to be marketed. Only Iskra with its "Centar za Elektrooptiku" from Ljubljana is betting on its own successes in development. Production is to start here in 1988. By then in this sector about 7.6 billion dinars will have been invested. Equipment purchases will be undertaken abroad. It is completely uncertain whether domestic buyers can then be found or whether products based on foreign licenses will be preferred. In addition, El-Nis is working on glass fiber technology.

Up to now in Yugoslavia in the telecommunications sector, the emphasis was largely on the acquisition of foreign licenses instead of their own coordinated development work. Yugoslav outlays to utilize foreign technology in the past few years amounted to almost $1 billion per annum. A study which was done in Croatia in connection with the current 5-year plan contains these figures.

Although only 2 percent of the total investment budget for telecommunications is planned for the new Jupak data transmission network which is to be used in business and financial administration, criticism focuses on expanding it. In view of the currently existing resolutions by the individual republics and provinces in Yugoslavia, three different networks will be installed. The weekly magazine NIN in Belgrade marks this action as being without equal worldwide and as an expression of the "fragmentation of the Yugoslav system

overall." The result will be that communication beyond the borders of the republics will be done with partners abroad. The competitive bidding process, the propriety of which NIN doubts, was completed this year. This resulted in the decision for a third system, since the republics of Bosnia and Hercegovina chose equipment from Energoinvest. This company did not get a chance in the other parts of the country. It uses hardware from Digital, which is combined with software of their own development. Croatia and Slovenia had decided in 1983 in favor of the Eripax system (Ericsson) which is supplied by Nikola Tesla in Yugoslavia. A decisive point of view for awarding orders was the short delivery time. Nevertheless, according to information in the press the system has not yet been put into operation. For the remaining republics the choice at the end of last year fell to El-Pupin and thus to a system from the FRG (EDX-P).

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UNITRON'S COPY OF MACINTOSH TO BECOME TEST CASE

Sao Paulo GAZETA MERCANTIL in English 15 Jun 87 p 7

[Text] Apple Computers of Cupertino, Calif., has warned that if Brasília fails to take action against Unitron, a Brazilian company which openly admits it is copying Apple's Macintosh MAC 512, the U.S. computer maker will "proceed with maximum energy to stop this scandalous act of piracy."

The announcement was sent to SEI, the Brazilian federal agency that enforces the "market reserve" policy restricting foreign investment in the computer industry. The warning was also sent to the Brazilian Embassy in Washington, the U.S. Congress and the White House.

In an advertisement printed in the Brazilian press, Unitron unabashedly admitted to having copied Apple's MAC 512, of which about 100 units have already been produced by Unitron. The company even admitted the possibility that Apple might sue.

On seeing the ad, Apple bought and dismantled one of Unitron's computers. The technicians quickly discovered that the computer's Read Only Memory (ROM) program had been copied down to the last line. An Apple spokesman summed up the company's conclusion: "this kind of behavior has a name: robbery."

The ad, however, was apparently designed by Unitron to pressure SEI to grant the company the right to make the MAC 512 under license from Apple. Unitron had two months ago applied for a license, but was turned down by SEI.

The copy, moreover, costs over triple the U.S. price for a MAC 512. Apple's man in São Paulo bought the pirated copy for $4,800 when the original costs $1,500 in the U.S.

Apple expects to send to Brazil this week a team of executives and lawyers to try to determine what action to take against Unitron. The outcome of the team's visit could have serious repercussions on the upcoming decision by President Ronald Reagan concerning whether or not to establish sanctions against Brazil in retaliation for the "market reserve" policy. Reagan has until the end of the month to make a decision on the issue.

Apple decided to launch the offensive as a means of testing Brazilian Ambassador Marcílio Marques Moreira's declaration that Brasília "is always ready to suppress any illegal acts by Brazilian companies." Apple, meanwhile, claims to have information showing that government-owned institutes, such as the Information Technology Center in Campinas, São Paulo, actually helped Unitron to decipher the Macintosh ROM.

"The Macintosh is our company's present and future," explains the Apple spokesman. "We can't allow Brazil to rob our technology because this would invite other countries to do the same. For this reason we will do our utmost on this case."

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ARGENTINE BANK FINANCES S&T PROJECTS

Buenos Aires ARGENTINA TECNOLOGICA in Spanish May 87 pp 9-15

[Text] In the presence of Governor Alejandro Armendariz, provincial ministers, authorities of official and private banks, and other representatives of the national scene, the Bank of the Province of Buenos Aires held a meeting to mark the third anniversary of the Professor Jorge A. Sabato Office of Development and Technology. In his keynote address, Dr Ferrer emphasized the important actions of this office, and reaffirmed the objectives that inspired its founding, in accordance with the policies outlined by the provincial government.

In a special note, Dr Luis Sibecas, manager of this area, provides us with his version of that unique experience.

After the introductory remarks, Dr Aldo Ferrer began his speech by stating: "Today we are commemorating the third anniversary of the founding of the Office of Development and Technology of the Bank of the Province of Buenos Aires. It bears the name of a dear friend of ours, Jorge Sabato. As we all know, he made substantial contributions to the theory and practice of technological development, and his work helped to shed light on the problems faced by a developing country such as ours, to affirm its growth potential, its sovereignty, and its possibility of establishing a presence in the world on the basis of its own national objectives."

Conditions and Criteria for Founding of Office

"When Dr Armendariz took office and appointed the present Board of Directors of the Bank, one of its first actions, within the framework of the provincial government's policies, was to found the Office of Development and Technology in January 1984. In this way, we were responding to a number of political conditions that were becoming apparent in this country, and to a number of conclusions that were being drawn from the work of people like Sabato with respect to the connection between technological development and economic growth.

"These conditions certainly included, above all, the country's return to democracy, to liberty, to a political regime identified with the national interest, with the promotion of creativity, with the mobilization of the

country's talent and resources. Within the context of these political conditions, this instrument was devised, based on certain fundamental criteria with respect to how technological change proceeds in a country like ours, and on an assessment of how the international system functions and what challenges face a nation such as Argentina.

"I will mention just a few of the fundamental criteria that prompted the founding of this office. First of all, there was a critical revision of an old concept of economies of scale that had been around for a long time. According to this theory, technological development was inexorably linked to great productive enterprises, which were the only ones capable of absorbing modern technology and of generating it. In other words, costs were reduced as the size of the plant grew. The experience of the post-war years, and especially of the last decade, has shown that this is not the case. Rather, due to a number of factors, technological development can in many cases and many sectors (even in cutting-edge technologies) be undertaken by small and medium-sized companies. In these companies, there are direct relations between the entrepreneur, his technical staff, and his workers, and it is possible to incorporate technology and to generate new knowledge. This critical revision of the theory of economies of scale is very important for a Latin American country, and certainly for ours, because it reveals that in fact the size of the market, traditionally regarded as a restriction, was not that at all. On the contrary, the capacity of human resources, the capacity of the business, and these trends in technological development that reveal the importance of small and medium firms as generators and assimilators of technological change, all open up truly significant opportunities for a country like ours.

"Another important circumstance is the obvious diversification of power on the international level, contrary to the belief in the early post-war years that the world would remain under the dominance of a few large powers and a handful of transnational corporations. The number of actors on the international scene is growing larger and larger; so is the number of countries participating in the most dynamic sectors of the world economy, and the number of companies that are innovating and generating technology.

"And naturally, this is tied to the fact that Argentina is a country whose traditional presence in the world system has been limited in practice, because we know full well what is happening to world trade, with protectionism, commodities, and the deterioration of traditional forms of trade. In any event, the only way we can regain our position in a dynamic way, even in the worldwide trade of primary goods, is to incorporate modern technology into our primary activity, and in other sectors of the national economy as well.

"This series of reflections on the way technological change occurs and how the international system behaves, ideas like those developed by Jorge Sabato in terms of the close links between the actors of technological change (scientists, businessmen, and political officials) prompted the provincial government and its bank to begin this action in the field of technological development as soon as its administration began."

Role of Banks

"At this point, people also reached the conclusion that the banks really have a lot to do with technological development. In this regard, the Bank of the Province has indeed been a pioneer, along with the Bank of the Nation, the National Development Bank, and the Banks of Cordoba and Mendoza, in creating ARGENTEC and identifying the technological variable as a key element in credit policy. As a consequence of this realization, this responsibility assumed by the banks, this office and ARGENTEC were established, the latter being a system of coordination among the various official banks I just mentioned. These entities have gradually advanced, and have attained considerable results. I will mention just a few of their accomplishments which give us reason to be very hopeful about what we can do in the future.

"In the first place, we banks have managed to establish concrete operative relationships with the entities that represent the Argentine science and technology system: the National Institute of Industrial Technology (INTI), the National Institute of Agricultural-Livestock Technology (INTA), the National Council for Scientific and Technological Research (CONICET), the Provincial Scientific Research Commission, the National Atonomic Energy Commission, and the Secretariat of Science and Technology. In other words, we have contributed in some way to the strengthening of these relations among the protagonists of technological development, although we have not yet attained an appreciable level of operative efficiency. We still have a long way to go, but through these relations among the banks and institutes representing the scientific and technical community, we know now what we have to do when an innovative entrepreneur comes to us to ask for support. We know--and the facts have proven it, because many projects have been approved--that if it is an industrial technology project, INTI will cooperate with us, and will evaluate the project; if it is in the agricultural-livestock sector, INTA will do the same; and if it is in the nuclear energy sector, the National Atomic Energy Commission will. Thus, we have functional operative relations that enable us to know how to evaluate a project technologically and to determine whether a project claiming to be innovative really is.

"Another element that we have been developing in conjunction with the banks of ARGENTEC, and even with the support of the national government, is the creation of certain currents of financing specifically earmarked for technological development. At the Bank of the Province, for example, as soon as the Office of Development and Technology began operating, we decided that loans would be extended on the best of terms, at a regulated rate, with longer terms. These loans would be accessible to innovative businesses in agriculture, livestock, industry, and other areas. Later on, the pot was sweetened with a credit line of 50 million australes, which the national government is channeling through the National Development Bank to support innovative firms on very good terms. Moreover, it is possible to articulate other sources of financing through this system, for exports, for example. In other words, we can offer a 'menu,' a combination of financial elements that can help the innovative company to form not only its fixed investment capital, but also its working capital, and even to finance its activity in international trade.

"Another aspect on which we have made appreciable progress, although a lot still remains to be done, is making our policies more flexible. At the Bank, almost as soon as the Office of Development and Technology opened, we established more flexible standards for dealing with various innovative firms than we had traditionally had in our transactions, because in technological change, even in advanced countries, there is a well-developed concept known as risk capital. That is, technological development has a risk component that is considerably greater than that involved in other types of activity, and it requires a flexible credit policy in terms of the ratio between the firm's own assets and outside resources. The traditional standards which banks apply to guarantee the security of their loans must incorporate a certain element of risk in this case, and financial institutions assume this risk with the understanding that they also have a responsibility to support the development of these innovative companies, which are in one way or another opening up new frontiers of growth in Argentina.

"At the same time, we have progressed, to a certain extent, in terms of placing at the disposal of innovative firms the international network possessed by several of the banks which belong to ARGENTEC. The Bank of the Province has its office complex in Sao Paulo, in several Latin American countries, and a major office in New York. In addition, the Bank of the Argentine Nation has a very important network of agencies in several different countries. Thus, we are hoping that these operative branches abroad will help the innovative companies gain access to other markets, to establish ties with foreign companies, and to facilitate joint venture partnerships and other cooperative schemes among Argentine firms, most of them small or medium-sized and technology-intensive.

"Another action that dovetails with those I mentioned before is the creation of LATINEQUIP nearly 2 years ago, with two major Latin American financial entities: The Bank of the State of Sao Paulo, and the National Finance Bank of Mexico. This effort is focused on a sector that is also intimately tied to technological change, the capital goods sector, which is of course linked to Latin American integration.

"When we look at what has happened in the past 3 years in the experience of the Bank of the Province and the 1-year history of ARGENTEC, even though we still have a long row to hoe, I have the impression that we have taken a number of firm steps which have generated new operational practices and response capacities on the part of banks, so that they can support and assist innovative firms in the diverse sectors of the national economy."

Continuity of Policies, Capital Market

Dr Ferrer went on to say: "When we look at the task that lies ahead in 1987 and the years to come in the process of turn-taking and democratic change which our newly regained freedom requires, the succession of governments, the confirmation of existing administrations or the replacement of them, depending on the popular will, I would say that we should aspire, and certainly do, to ensure that these things which we have done, which we consider truly essential to the national interest and to the future growth of the country, will be incorporated permanently in the operations of this bank and the others that

belong to ARGENTEC. In other words, we want--within the framework of the policies of the provincial government of Buenos Aires and those of the other banks in their provincial governments and the national government--for this element, the technological variable, to be implanted once and for all as a factor in the operating policy of these financial entities.

"In addition, we must strive with perseverence this year to consolidate our operative relations with the agents of technological change, with the businesses, to publicize our actions and improve our operative ties, making them more expeditious and rapid. And this depends, in part, on what we do; it also depends on the changes that must be made by the entities that represent the scientific and technical community. We have a long way to go in terms of improving procedures, cutting red tape, and so on.

"Another important aspect is the expansion of this menu, this combination of financing instruments which we are offering to innovative firms. At the Bank of the Province, we have been working in recent weeks on the idea that the innovative firms need not only credit and credit support for fixed investments and working capital (that is, risk loans), but they also need to expand their own capital. So we are going to move into the area of helping businesses expand their capital, underwriting preferred stock in these firms. We must find some way to get these firms into the capital market.

"In the last few days, some very encouraging indications of the national policy have come to light. They confirm what the president of the nation announced at the Stock Exchange last year, that a series of measures will be taken to help truly dynamic and innovative firms with growth potential to gain access to the capital market, through tax incentives and other means. We must create the conditions for overcoming this 'short-termism' that the country has inherited as a consequence of everything it has been through and of chronic inflation, to stimulate investment in capital stock. Here we banks also have a lot to do, because we can somehow serve as intermediaries for the companies that issue these stocks and these bonds representing part of their capital, providing guarantees that will expand their possibilities for gaining access to the capital market. At the Bank of the Province we have had an interesting experience with the Housing Value Bonds, whose specific function is to mobilize resources from the capital market for an activity which is equally essential, housing construction. That is, we must make an effort--and when all is said and done, the banks are supposed to know something about this--to identify new financing instruments that will truly channel additional resources toward these innovative companies."

Country Has Innovative Capacity

"It is also important to help popularize the theme of technology. I get the impression that sometimes our messages are too technical, too cold. We say things which are certainly true, or at least we assume they are, but Argentine society must become increasingly convinced that the country's future really depends on our ability to apply the tremendous talent that exists among our workers, businessmen, scientists, and technicians; and then we must find ways to reach public opinion with more direct, more popular messages that will inspire the imagination of that public.

"These are the things we must do, but I think it would be unfair for me to leave out what we have done. At the Bank of the Province of Buenos Aires, for example, we have already approved 44 projects, with a total investment of 133 million australes, which is a considerable investment. Nonetheless, one of the most encouraging benefits we have derived from this experience is the actual confirmation that there really is a capacity for innovation, that there is an entrepreneurial spirit, that there are a lot of talented people capable of developing sophisticated technology on the basis of their own innovations as well as the adaptation of imported technology.

"In ARGENTEC (the system we formed with the Bank of the Nation, the National Development Bank, and the Banks of Cordoba and Mendoza, with an important network of associated banks including many other provincial bansk and private banks), there are already 12 projects that have been approved and a total portfolio of nearly 70 projects, also with considerable investments. Little by little, this system is strengthening its ability to offer these opportunities to innovative firms. The companies are moving closer, and events are occurring which we find significant and which will certainly multiply in the future.

"Some important byproducts have emerged from this action in the area of technological development, which includes frequent meetings in this country and abroad to debate these issues. For example, as a result of meetings held to discuss these issues right here and in other places, associations of Argentine businesses have been formed, joining together some large Argentine enterprises with small, technology-intensive firms. Such meetings have also produced associative projects with foreign businesses. In other words, a sort of critical mass of relationships, of ties, is developing somehow, and new opportunities are arising from it. As a result, we are gaining more confidence in our own abilities. The private sector and the essential creativity of private initiative in the promotion of growth, especially in these innovative areas, are thus finding their own ground, not only because the country has returned to democracy and liberty (and therefore the rules of play, though not lacking serious difficulties, are now identified with the national interest and the promotion of intrinsic growth capacity), but also because we now have new financing instruments which did not exist before the Bank of the Province of Buenos Aires established its Office of Development and Technology, and before the group of banks belonging to ARGENTEC established this system of cooperation which we have called Technological Argentina."

Finally, Dr Ferrer expressed his gratitude to the officials and the audience, who filled the facilities of the Bank's Historical Archives and Museum. Then he invited the governor to close the meeting.

Dr Alejandro Armendariz

"I was not planning on speaking at this moving event, but Dr Ferrer, with his proverbial enthusiasm, has prevailed upon me at this very moment. So I will improvise a few words to contribute to this important event, the third anniversary of the founding of the Office of Development and Technology at the Bank of the Province of Buenos Aires. We must recall that this office and

this area have been named after Professor Jorge Sabato, a man who without a shadow of a doubt came here to project his own clear ideas, one of those men whose spirit, whose science or art make them great, who set genuine examples for national life and who serve the higher interests of the nation.

"The province of Buenos Aires, in its desire to grow, has always been well aware of the triangle mentioned a few moments ago by Dr Ferrer, at whose points Professor Sabato placed science, business, and government, so that at the very apex we would find the inspiring nexus of the country's socioeconomic progress. This shows us that in the interrelation of these sectors could be found the expected solutions. To be sure, the men who conduct research, the men who produce goods and services, and the men who make political decisions are the ones who will determine the progress of a nation.

"Argentina is undergoing a severe crisis, a tremendous crisis, perhaps the most difficult one in her entire history. She has proven, however, in every period of history, that when things get bad, the entrepreneurial spirits, the strong and capable men, the clear-thinking men able to overcome the problems of the moment, come to the fore. I believe that if we value the extraordinary natural resources we possess and have faith in the Argentine citizen, in the man who works every day, in the man who conducts research, in the man who knows how to take business risks, and in the man who carries out decisive tasks in political office, then we will be able to get through these times. I have absolute faith that we will find our way out of the swamp. What's more, we are emerging now despite the difficulties we face every day. And in this way, with our faith intact and our hope renewed, I say to you that I fervently believe in the great future of Argentina. Thank you very much."

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BRAZIL'S FINEP PLANS TO INCREASE S&T FINANCING

Sao Paulo O ESTADO DE SAO PAULO in Portuguese 20 May 87 p 23

[Text] Porto Alegre--The Studies and Projects Financing Authority (FINEP), an agency of the Ministry of Science and Technology, will invest approximately $4 billion cruzados this year--five times more than in 1986--in the development of the technological capability of national companies. This information was revealed in Porto Alegre yesterday by FINEP Chairman Fabio Celso de Macedo Guimaraes, who considered this investment demand to mean that "the behavior of the companies may be cautious in the short term due to the economic situation but, in the long term, they are making investments."

According to him, while there were 300 financing operations with national companies all of last year, in the first 4 months of this year FINEP has already registered 300 financing operations with companies for investment in the development of technological capability in private enterprise. He added that the principal area of investment is the chemical industry, followed by the electronics industry.

The FINEP chairman declared that the economic crisis has not yet been reflected in the allocation of funds for research. He stressed that the funds of the National Scientific and Technological Development Fund (FNDCT), administered by FINEP--which finances scientific research in universities--were increased 100 percent in 2 years. The FNDCT will have 1.3 billion cruzados in 1987 but should receive a 1.5-billion cruzado supplement.

In addition to its own funds, this year FINEP will have 3 billion cruzados from the National Development Fund, which will be used for the financing program for companies; 900 million cruzados of this total have already been released. According to Fabio Celso de Macedo Guimaraes, FINEP's investment priorities are in the areas of informatics, fine chemistry, new materials, biotechnology, and precision mechanics. Last week, FINEP signed an agreement with the Federal Data-Processing Service (SERPRO) in the amount of approximately 500 million cruzados for a survey of the companies with the capability to develop software.

8711
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BRAZIL TO USE PATENT DATA BANK TO AID DOMESTIC R&D

Sao Paulo O ESTADO DE SAO PAULO in Portuguese 2 Jun 87 p 5

[Text] The National Institute of Industrial Property (INPI) is launching a biotechnology program to publicize among scientists and businessmen in that area the use of patents as the source of technological information and the instrument of protection of industrial property. As a first step the institute has already signed a contract with the Oswaldo Cruz Fund establishing a system for the regular supplying of copies of patent documents in this field and keeping the institution informed about new developments and the current technological trend.

The INPI has already listed 23 organizations that have an interest in the biotechnology program. Participating in the contacts will be the Secretariats of Science and Technology of the states that have a biotechnology program, such as Minas Gerais, Sao Paulo, Parana, and Rio de Janeiro, where the Bio-Rio Pole is being established. Three of the 23 organizations are already participating in the Program for the Automatic Supplying of Technological Information (PROFINT) and shortly should sign a contract similar to the one with the Oswaldo Cruz Foundation. They are: Bioquimica Brasil (BIOBRAS), Technological Development Company (CODETEC), and Leivas Leite Corporation--Chemical and Biological Industry.

Patent documents, one of the richest sources of technological information, are rarely consulted by the researchers in our country. This being the case, the INPI, which has the largest patent bank in Latin America, with 18 million documents, has an important role to play among the technical-scientific community in the dissemination of that information. That reliable source will save them time in research since a significant percentage of the technological information is available in the patent documents.

In addition to that, it is known that highly important research conducted in Brazil is not duly protected because of unfamiliarity with the role of the patent as industrial property. As a result of this unfamiliarity with the matter, among other factors, debate about the protection of inventions in the biotechnological area has been very inadequate. Thus, the program indirectly aims at forming a critical mass that in the middle term may enrich this debate.

The program seeks to stimulate the patenting of the result of research that has industrial application in addition to representing innovation and inventive activity. In areas where national legislation does not permit the granting of patents, the possibility of protection abroad may be evaluated, utilizing the facilities of the Patent Cooperation Treaty (PCT) of which the INPI is a signatory. The treaty provides for lodging a patent request in various countries.

The program will also include visits of an exploratory nature to research centers, universities, and companies with a view to publicing the services rendered by the agency. The program also includes advisory service to the organizations in view of the difficulty of scientists in understanding the structure and technical and legal language of the patent document. The objective of the visits envisioned will be to evaluate the assimilation of the knowledge acquired from the technological information.

Modern biotechnology, prominent among which are genetic engineering techniques, is based principally on the processes of obtaining products from microorganisms and traditional genetic improvement. Although prior to the discovery of genetic engineering, Brazilian legislation makes it clear that the majority of biotechnological inventions cannot obtain patents in Brazil. One of the basic problems in patenting is the precision of description of its object in such a manner as to enable a specialist in the area to replicate the results obtained. Another problem is that some inventions in that field frequently deal with mere discoveries of products of nature and as such are not patentable.

Despite those difficulties, the international trend in that area is tending toward protection by patent. Inventions may be divided in the following manner: of a product, related to an organism or material, such as animals, plants, microorganisms, and viruses; and of a process, for example, the creation of a live organism or the production of other biological material. In Brazil, research development is currently being concentrated in the areas of health and food.

In the Brazilian case, the current Industrial Property Code does not grant a patent to food substances, materials or products; chemical-pharmaceutical substances, materials or products, and medicines; as well as the respective processes of obtaining or modifying them. In 1984, the World Intellectual Property Organization (WIPO) undertook a study concerning protection for biotechnological inventions. It was determined that there was a trend to broaden the concept of what should be a biotechnological system and what should be considered an invention. According to the proposal, biotechnology would encompass live organisms of natural or artificial origin as well as biological materials such as cellular strings, tissue culture, and even seeds, in terms of the granting of patents. For the time being, the proposal is to extend protection only to varieties of plants and breeds of animals.

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FINEP, SERPRO TO AID PRODUCTION OF DOMESTIC SOFTWARE

Rio de Janeiro DATA NEWS in Portuguese 25 May 87 p 5

[Text] FINEP and SERPRO concluded a cooperation agreement that will benefit the production of software.

The companies that are prepared to develop and acquire national software and have the endorsement of the Federal Data-Processing Service (SERPRO) to do so will be able to request an advance of funds for their activities from the Studies and Projects Financing Authority (FINEP).

The agreement also provides for the financing of projects contracted by SERPRO itself, its participation in the analysis of plans presented to FINEP, and its technical support in activities of enhancing the capability of that agency's personnel. In addition to that, SERPRO and FINEP agreed to make a mutual allocation of employees for the purpose of performing tasks that are of interest to both. "This means that SERPRO is prepared to bank the warrantor for the small companies to place their small packages on the market, in addition to formalizing an old collaboration arrangement with FINEP," explained SERPRO Chairman Ricardo Saur.

According to Saur, the principal result of the agreement signed with FINEP is the coordinated mobilization of public funds for the informatics area as specified in Planin. In this manner, the use of national software would be increased, following the example of public enterprise.

According to the chairman of the agency, SERPRO has about 400 copies that are being used in the context of this philosophy and has already certified the SPP software of Minimicro, and Dialog of Soft Consultoria, according to the rules of the agreement with FINEP. In Saur's opinion, the "chain effect" of this action has already begun, as demonstrated by the Federal Savings Bank and the Bank of Brazil in acquiring programs under that concept.

That official believes that the lack of definition of the software segment has brought about distortions that are difficult to rectify to this day. "The undue use of foreign programs became generalized even in the public area, and until recently could be found in SERPRO itself."

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BRAZIL TO MANUFACTURE PRECISION QUARTZ

Sao Paulo GAZETA MERCANTIL in English 1 Jun 87 p 7

[Text]

Insulin producer Biobrás and the Leme industrial engineering group have joined forces with two other companies to form Tecnoquartz, a new company specializing in the production of quartz-based single crystals, a crucial input for the electronics, weapons and computer industries.

Brazil holds 90% of the world's quartz reserves, but exports the quartz in raw form at $1 a kilo and imports the single crystals at $120 a kilo. Leme director Clávio Campos de Amaral hopes that Brazil can grab a tenth of the world trade in quartz, which he estimates at $1 billion, and move into the more sophisticated and lucrative single crystals business.

Tecnoquartz will begin by experimentally producing 200 kilos (440 pounds) a month of single crystals at the industry and technology center of the state of Minas Gerais. After initial production, the company plans to invest $5 million in a new plant.

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